

SITE EMERGING TECHNOLOGIES:

**BIOSCRUBBER FOR REMOVING HAZARDOUS ORGANIC EMISSIONS
FROM SOIL, WATER AND AIR DECONTAMINATION PROCESSES**

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FOREWORD

The U. S. Environmental Protection Agency (EPA) is charged by Congress with protecting the Nation's land, air, and water resources. As the enforcer of national environmental laws, the EPA strives to balance human activities and the ability of natural systems to support and nurture life. A key part of the EPA's effort is its research into our environmental problems to find new and innovative solutions.

The Risk Reduction Engineering Laboratory (RREL) is responsible for planning, implementing, and managing research, development, and demonstration programs to provide an authoritative, defensible engineering basis in support of the policies, programs, and regulations of the EPA with respect to drinking water, wastewater, pesticides, toxic substances, solid and hazardous wastes, and Superfund-related activities. This publication is one of the products of that research and provides a vital communication link between the researcher and the user community.

Now in its eighth year, the Superfund Innovative Technology Evaluation (SITE) Program is part of EPA's research into cleanup methods for hazardous waste sites around the Nation. Through cooperative agreements with developers, alternative or innovative technologies are refined at the bench-and-pilot scale level and then demonstrated at actual sites. EPA collects and evaluates extensive performance data on each technology to use in remediation decision-making for hazardous waste sites.

This report documents the results of 11 months laboratory-scale testing of an engineered biofilter using an active synthetic medium. Effective and efficient removal for a low level organic contaminant, toluene, from air was demonstrated. A pilot-scale stand-alone unit with a compressor, biomass removal capabilities, and an inorganic nutrient supply/recycle system capable of handling 4 CFM of flow, was designed and constructed. The unit will be used for field pilot testing under an unattended mode of operation.



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ABSTRACT

An engineered biofilter was developed to digest hazardous organic emissions from soil, water, and air decontamination processes. A bench scale under the SITE Emerging Technology Program was tested for >11 months for the removal of low level toluene in air.

The bioscrubber contains a selected activated carbon medium to support microbial growth. The bioscrubber was designed for large volume air streams containing trace volatile organics. Almost complete removal of hazardous organics was demonstrated. Compared with other biofilters using compost or other naturally occurred media, the use of activated carbon in the bioscrubber enhanced the degradation efficiency substantially for the test performed.

The bioscrubber efficiency results from the adsorption affinity and ideal environment for biogrowth offered by activated carbon. The adsorption affinity provides a sink for contaminants to enhance the biodegradation efficiency. It also cushions the feed fluctuations to achieve a consistent and high level removal efficiency. In a bench scale-unit, >95% removal was demonstrated for an air stream containing <5 to 40 ppm of toluene.

A pilot-scale test unit, capable of handling 4 CFM of flow, was designed and constructed. It is a stand-alone unit with a compressor, backwashing capabilities, and an inorganic nutrient supply/recycle system. The unit was intended to be used in a field test under an unattended mode of operation.

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EXECUTIVE SUMMARY

Biofiltration has been accepted recently for trace contaminant removal from air. The existing technology uses naturally occurring materials, such as compost, bark, peat, etc. Under the SITE Emerging Technology Program an engineered biofilter has been developed using an active synthetic medium activated carbon, which offers more effective, reliable and efficient operation. Through advanced engineering design, this filter incorporates the features of bio-mass removal, nutrient supplement, and moisture addition. This advanced filter was developed based upon > 11 months of operating experience using a bench-scale unit. The unit consistently demonstrated > 95% of removal efficiency for an air stream contaminated with ~10 ppm of toluene with an empty bed contact time of ~1 second. Its degradation rate was 40-80 times higher than the rate of existing systems using naturally occurring materials under the performed condition. This enhanced degradation efficiency is probably due to the adsorption offered by the activated carbon to enhance the substrate concentration.

In addition to the efficient degradation, the biofilter with activated carbon media provides an effective sink to cushion the feed fluctuation. This was evidenced by the consistent removal of the contaminant during the > 11 months of operation with a feed fluctuated from < 5 to 40 ppm. Pressure drop of 0-20" of water was observed during the 11 months of operation. The pressure drop was primarily attributed to the restriction and flow distribution experienced with a small-scale bench-top unit. The actual pressure drop for a bio-filter is anticipated to be minimal due to the use of a shallow bed.

The biomass generated from the filter is believed to be similar to the sludge generated from the biological water and wastewater treatment. If non-biodegradable contaminants are present in the feed, they may be trapped in the bio-mass due to the exposure of the biomass to the feed. Further study may be necessary to determine the extent of the accumulation and, if necessary, an appropriate disposal of the bio-mass.

The proposed technology will have a wide spectrum of applications to clean up superfund sites. Potential areas include: (1) organic emission control for groundwater decontamination using air strippers, (2) emission control for biological treatment of ground and surface water, and (3) emission control for soil decontamination. These primary treatment processes currently under development or practice have not been designed to prevent VOC emission from discharging into the atmosphere. However, the requirement of treating these airborne pollutants may cause these treatment processes to become expensive or prohibitive economically. The proposed technology is an ideal post-treatment for these processes due to its effectiveness in handling trace organic volatiles economically and effectively.

The bioscrubber developed here using activated carbon as a medium provides several operational advantages over conventional activated carbon adsorbers for the above applications. The bio-regeneration keeps the maximum adsorption capacity available constantly; thus, the mass transfer zone remains stationary and relatively short. No regeneration of the carbon is required and the bed length required is greatly reduced. These features translate into a reduced capital and operational cost. The bioscrubber's advantages would be fully

utilized when off-gas contains weakly adsorbed contaminants, such as methylene chloride, or adsorbates competing with moisture in the stream. Finally the chromatographic effect (or premature desorption) commonly experienced in an adsorber would not exist because the maximum capacity is available constantly. The bioscrubber is anticipated to replace some existing applications currently using activated carbon.

A pilot unit has been designed and constructed and will be field-tested at selected Superfund sites in the near future. The unit includes a feed delivery system with a compressor, an inorganic nutrient storage and delivery system and the bio-mass removal device. The unit is intended to be operated under an "unattended" mode.

II. INTRODUCTION

Biofiltration, in its most general sense, is the removal and decomposition of contaminants from gases into nonhazardous substances through the use of micro-organisms. Bio-filters are believed to be the most economical way to treat the low level contaminants (up to several thousand ppm) in gas streams.

For efficient operation, the filter media must meet several requirements:

- Provide optimum environmental conditions for the resident microbes
- Consist of uniform pore size and particle structure (for low bed pressure drop, minimizing gas channeling, high reactive surfaces)
- Have minimal bed compaction (minimize maintenance, media replacement)

Composition of an existing commercially available biofilter, compost and other naturally occurring media, generally satisfies the first requirement by providing sufficient nutrients for the micro-organisms (typically bacteria), except for particularly refractory contaminants (i.e., chlorinated compounds). The problem with composting, however, is the huge space requirement compounded by continual loss of effective surface area during biomass build up (slothing).

An activated carbon-based biofiltration module, a bio-scrubber, has been developed to improve the existing bio-filtration systems. These synthetically produced filters address the current deficiencies of composting and other naturally occurring media-based biofilters. Its advantages are:

- Low pressure drops
- Minimal pressure drop loss due to slothing
- Much smaller bed requirements (allows the use of compact filters only)
- Allows removal of biomass if necessary
- High water retention in the microporosity (long shelf life while not in use; during start up/shut down, minimal requirement for additional water addition)

In addition, activated carbon media beds provide one more key separation mechanism for biofilters, adsorption of gases onto the carbon. This provides the following advantages:

- Increased surface concentration of contaminants
- Removal of hydrophobic gases that would not typically be absorbed into the aqueous phase
- Allow the biofilter to be efficient at lower concentrations of contaminants

The above attributes also could result in enhanced biodegradation of substances that would not typically be efficiently degraded in a biofilter providing additional applications for the technology.

This study focused on the development of an advanced biofilter using selected activated carbon as media. The engineering consideration required included (1) environment for biogrowth, (2) nutrient supplement device, and (3) biomass removal mechanism. The filter thus developed demonstrated an efficient and effective removal of toluene removal from air for >11 months of operation.

III. CONCLUSIONS AND RECOMMENDATIONS

A bench-scale bio-scrubber was operated for >11 months, successfully demonstrating an effective and efficient removal for a low level inorganic contaminant, i.e., -10 ppm of toluene in air. The unit is packed with a selected granular activated carbon, instead of compost-type media used in the existing biofiltration technologies. This reusable active medium allows the removal of the biomass, when necessary, to prevent the compaction of the medium as experienced using existing technology. In addition, the unit demonstrated 40-80 times higher biodegradation rate than the existing technology's under the testing condition. The pressure drop experienced during the 11 month period is minimal, i.e., 0 to 20 inches of water for most of the time. The occasional removal of the biomass helps to control the pressure drop at this desirable level. The unit offers a desirable environment for biogrowth by maintaining a humid state and supplementing inorganic nutrients. A pilot unit has been designed and constructed with these features, and field-testing at selected superfund sites is recommended.

IV. DISCUSSION

A. BACKGROUND

After the award of this project by US EPA (CR-816813), several biofilter systems developed in Europe were introduced into the U.S. Although these biofilters are different from the bioscrubber developed here, they share the similarity in terms of application and basic principle. In addition, a review paper⁹ was published summarizing the state-of-the-art biofiltration technology. The literature review here highlights the key elements involving the existing commercially available technology outlined in Reference 9 as baseline information for bench-marking purposes.

1. General Overview

Biofiltration is now a well-established air pollution control technology in several European countries. As many as 500 biofilters are currently in use in Germany and the Netherlands. Some development and installations have been

made in the United States since ~1960's, although to a much lesser extent¹⁻⁸. Control efficiencies of >90% have been achieved from many common air pollutants. Due to lower operating cost, bio-filtration if applied to appropriate systems can provide significant economic advantages over other air pollution control technologies. It is suitable for off-gases containing readily biodegradable pollutants in low concentrations, typically less than several thousand ppm as methane. Environmental benefits include low energy requirements for operation and a complete degradation of the pollutants.

Biofiltration is a technology utilizing a fixed-biological film supported on the solid phase to remove air contaminants from off-gas streams through aerobic degradation. End products from the complete biodegradation of air contaminants are CO₂, water, and microbial biomass. The oxidation of reduced sulfur and chlorinated organic compounds also generates inorganic acids, which could change the pH of the system and possibly are toxic to the bacteria.

2. Configuration

To date, most biofilters have been built as open single-bed systems. Open, multiple story systems are also built if space constraints exist. Some European firms have developed enclosed systems usually with stacked beds. Media used include compost, mineral soil, peats and others. Microscopically, a biofilter can be perceived as a biofilm established around the media; a concentration profile exists from the bulk gas stream through the biofilm and then to the solid surface. A first order degradation kinetics has been suggested although the actual degradation kinetics is probably far more complicated. Many of the existing biofilters are single systems installed on livestock and food processing applications. Filter areas typically range from 100 to 22,000 ft² (10 to 2,000 M²) with off-gas flow rates between 600 to 90,000 CFM (1,000 to 150,000 M³/hr).

3. Key System and Operating Variables

• Acclimation

For common, easily biodegradable organic compounds, acclimation typically requires about 10 days. If compounds, that are less biodegradable and for which suitable microorganisms are less likely to be initially present in the filter material, are to be treated, inoculation with an appropriate culture can reduce the acclimation period, and such inoculation is practiced by several firms.

• Temperature and Degradation Rate

For optimum results, it is recommended that the off-gas temperature be maintained between 20 to 40°C (68 to 105°F). A decline in removal efficiency could occur at lower temperatures, particularly <10°C. Degradation rates of common air pollutants typically range from 10 to 100 g/M²/hr. The degradation rate for toluene was reported to be 20 to 30 g/M²/hr for the concentration ≥ 200 ppm. A nearly linear relationship between the degradation rate vs. concentration was reported for the concentration ≤ 200 ppm.

- **Flow Rates**

Filter loads of up to 300 M³/hr of off-gas per M² of filter (16 scfm ft²) are usually feasible without resulting in excessively high back pressures. Surface loads as high as 500 M³/m²/hr have been treated with good removal efficiency. The pressure drop at 300M³/hr/M² is about 6" and then increases to -20" of water at > 500 M³/M²/hr. An improved medium mixed with coarse bark reduces the pressure drop significantly.

- **Surge and Intermittent Loading**

The filter's huge buffer capacity prevents breakthroughs during peak loadings, and allows sizing based on hourly average rather than instantaneous peak loads. The buffer capacity of a filter for a particular application will vary depending on water solubility of the target pollutants and surface loading rates. Most industrial sources of air pollutants do not operate continuously. It has therefore been of interest whether the biological activity of a biofilter could survive during extended shut-down periods. It is suggested that filter beds can survive at least two weeks without any significant reduction in microbial activity. If sufficient nutrients are provided by the filter material, survival periods of up to two months can be expected.

- **Media**

Compost, usually produced from municipal waste, wood chips, bark or leaves, has generally been the basis of filter material used in recent applications in Europe. Peat and heather mixtures have also been used. The bio-filters originally built in the US were mostly "soil-beds" for which biologically active mineral soils were used as filter materials. Preferred fresh material properties include a pH between 7 and 8, a pore volume of greater than 80%, and a total organic matter content, measured as LOI, of >55%. Activated carbon can be used to increase the filter's buffer capacity for emissions from sources that operate only intermittently. This can reduce the filter volume significantly.

Typically, a compost-based filter material will provide sufficient inorganic nutrients from microorganisms and the addition of nutrient will not be required. In some cases, however, depending upon the target pollutant and the source of the filter material, the availability of specific nutrients might become a process limiting factor. The fresh media are required to be tested for potentially hazardous constituents (e.g., heavy metals) before installation in the filter in order to avoid the potential complication in disposal of spent material.

4. Maintenance Requirement

The off-gas must be saturated with water since it would otherwise remove moisture from the filter material resulting in drying of the bed, the death of most organisms and a total loss of control efficiency. Spray nozzles usually provide the required humidity in the humidification chamber. Additional automatic irrigation of the filter beds from the top is also used in some systems to maintain the required moisture content in the filter materials. A useful life for filter materials of up to three to five years has been

reported. Maintaining the porosity of the compost by turning it over, and/or replacing it entirely, once spent, are the second major maintenance requirements for biofilters with compost-bed filter materials.

5. Cost

The operating cost is about \$0.60 to \$1.50 /100,000 ft³ off-gas in Europe \$0.30 to 0.60 is reported in the US.

6. Future Improvements

Reported failures in the operation of the existing biofilter include:

- Insufficient treatment due to under size of the filter
- Off-gas is toxic to microorganisms, e.g., SO₂
- Insufficient humidification

Generation of acidic degradation end- and by-products can result in a drop in pH and destruction of the microbial population.

- Rapid compaction of inappropriate filter material can often, in combination with inhomogeneous humidification, result in the formation of cracks and breakthrough of untreated off-gas.

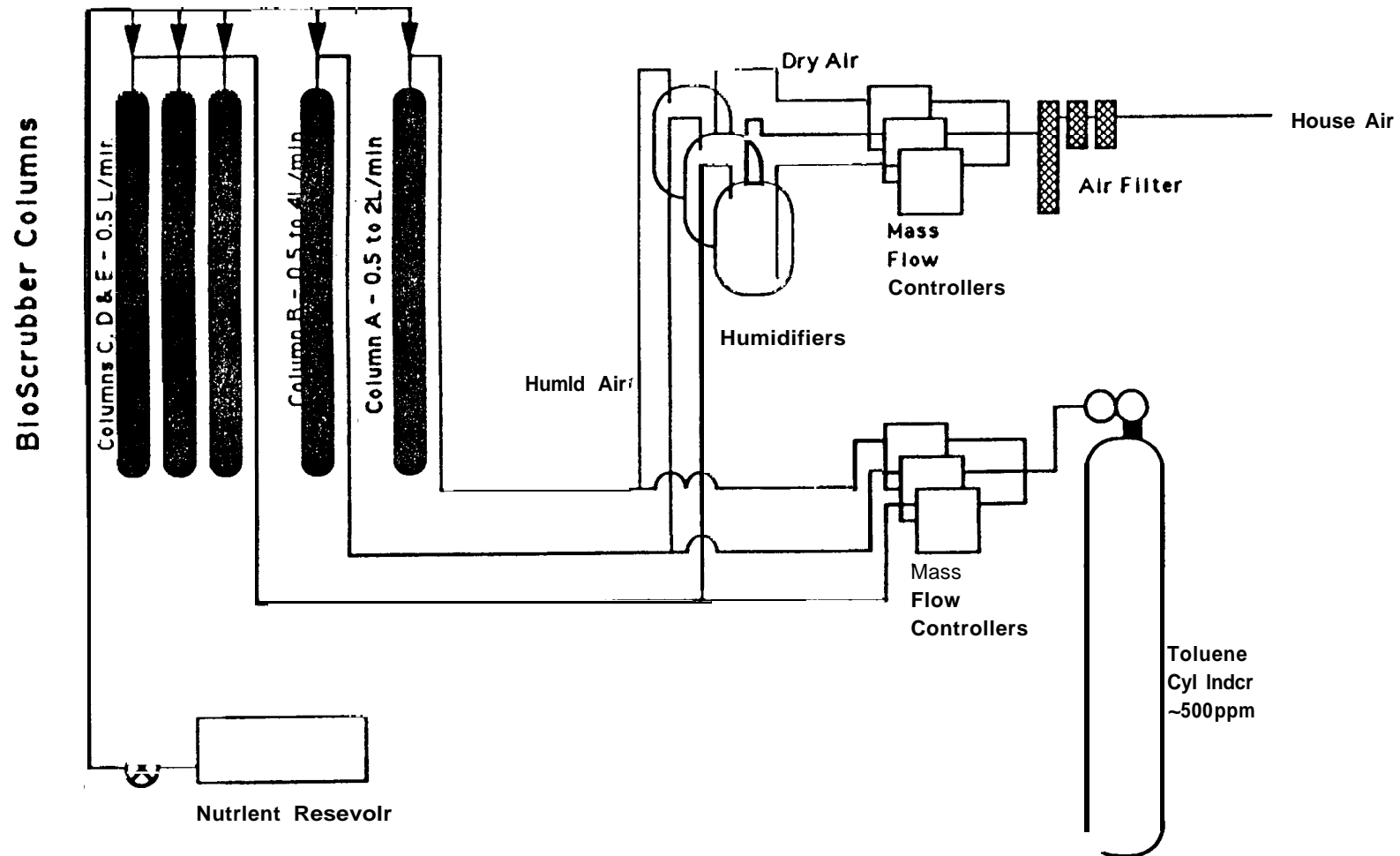
Compaction should be kept to a minimum reducing the need for maintenance and replacement of the filter materials. Mineralization of the organic matter in bio-filters will eventually lead to compaction of the filter materials and a corresponding increase in back pressure. Future improvement in the physical properties and longevity of the filter material is needed because they will result in reduced cost for energy and maintenance.

In summary, the use of biofiltration has demonstrated a viable and economical way to remove trace contaminants from air. Elimination of the compaction with an improved filter media and a biomass removal device offers an opportunity to correct the deficiency of the existing bio-filter. In addition, the use of the natural media requires a large surface area, which may be a constraint in certain applications. The objective of this study was to develop an engineered medium/filter with the following features: (1) avoidance of the compaction of the medium (2) reusable media, thus no replacement and disposal requirement, (3) more effective, thus can offer a space-efficient and more controlled filter. Use of a selected granular activated carbon could satisfy the above need if a proper engineering design is built in to provide a suitable environment for bio-growth. A benchscale unit was designed and operated for >11 months successfully in the lab. The result from this operation is discussed in the following.

B. APPARATUS

1. General Description

A bench-top bioscrubber testing unit including the biofilters and gas supply, was assembled in the laboratory. The bench-scale apparatus (Figure 1)



1. Bench Scale Representation (not to scale)

consists of five parallel glass columns (2.5 x 61 cm), each of which is connected to one of two humidified air streams (0.5 to 4 l/min). Each air stream contains ~10 ppm of toluene.

Three glass columns with 2.5 cm ID and ~60 cm L were packed with selected activated carbons (US Mesh 10x14) as filters. Four sampling ports were installed along the axial length of the column for gas sampling and pressure drop measurement, as shown in Figure 2. Air containing 10 ppm of toluene was prepared by diluting the custom premixed gas containing 500 ppm of toluene in air. Flow rates ranging from 0.5 to 4 liter/min were controlled with MKS mass flow meters and controllers. Both feed and effluents were sampled with a Precision gas tight 1 ml syringe, then analyzed by gas chromatography (GC). The method of detection limit was determined to be 0.86 ppm. The analytical method is detailed in Section V. Pressure drop was measured with a Magnahelic pressure gauge (0 to 100" water). Excess biomass was removed as required by manually removing, gently washing and replacing the affected carbon in Zone A. Inorganic nutrient, required for biological growth, was fed to the column down flow at a 0.1 ml/hr rate. A picture of the bench-top unit and its delivery system is presented in Figure 3.

2. Influent Air

The humidified air stream is prepared by passing bottled breathing air through a Balston cleaner/dryer (type A, BX, DX) and then through a sparging bottle containing deionized water. The sparging bottle temperature is maintained by placing the unit in a Blue M Magni-Whirl constant temperature bath. The humid air stream is split and the flow rates of the two streams are controlled by a mass flow controller (type 1259 MKS, Inc). The toluene containing gas, 500 ppm is mass controlled and mixed with an air stream to produce a humidified air stream containing 10 ppm toluene (refer to Figure 1).

The humidity and temperature of the two influent streams is continuously monitored by in-line Panametrics moisture probes (type M2LRT) connected to a Panametrics System I hygrometer, interfaced to a two-channel strip chart recorder. A septum port is connected at the outlet of each probe assembly to facilitate syringe sampling of each toluene-laden stream at specified intervals. Each air stream is separately connected to manifolded Cole/Parmer rotameter/controllers and split into five isolated streams (refer to Figure 2). These streams are defined as the influent to each column.

3. Filter Configuration

The five columns are identical with respect to materials of construction. Each is a 2.5 x 61 cm ACE Glass Inc air sampling manifold with two threaded (nylon) sampling ports attached at 1/4 and 1/2 the length of the tube. The threaded endcaps are PTFE with 1/4" NPT female outlets. A 304 SS screen (20 x 20 mesh) is placed on top of the bottom endcap to support the granular activated carbon (GAC). The effective volume of each column is ~295 ml.

The branched inlet to each column provides connections for influent, pumped nutrient solution, and a pressure gauge to monitor back pressure in the column. The outlet tubing is open to the atmosphere except when connected to the effluent sampling chamber.

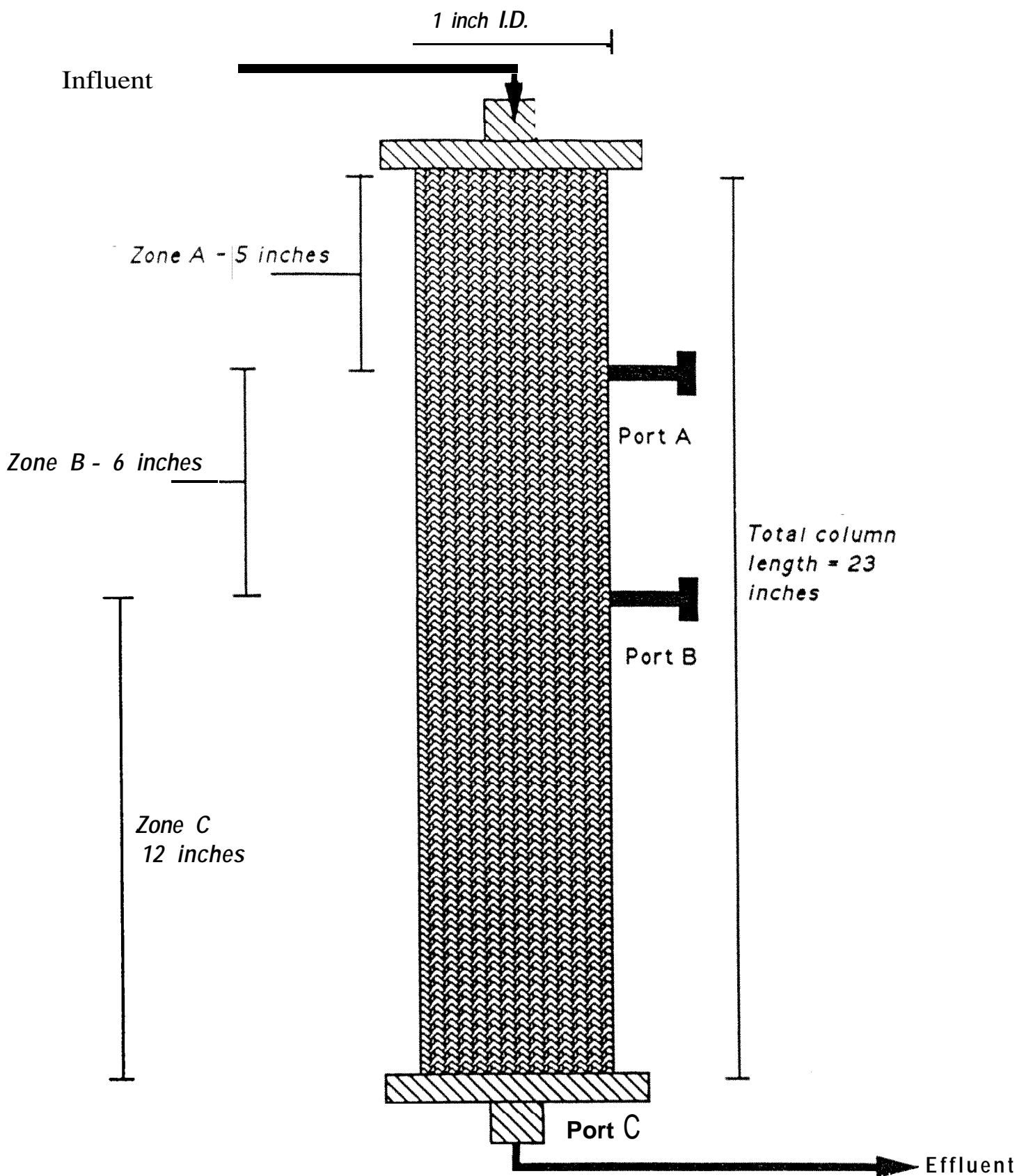
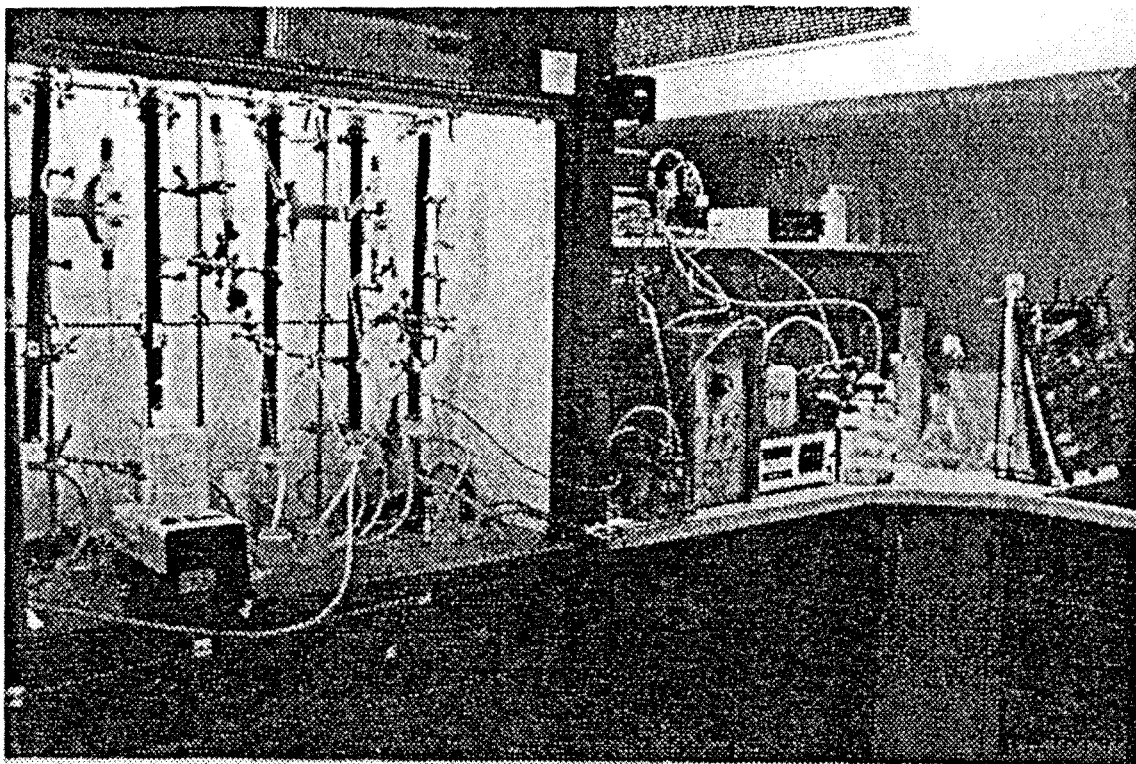


Figure 2. Schematic of Bench-top Bio-Scrubber Unit

Figure 3. A Bench-Scale BioScrubber Unit with Gas Delivery System



The effluent sampling chamber consists of an in-line Panametrics moisture probe assembly with a septum port connection on the outlet of the probe assembly. This chamber provided effluent humidity and temperature data and a convenient port at the specified sampling interval. There is only one effluent sampling chamber for all effluent columns. The chamber is connected to the column of interest and purged for 2 minutes prior to sampling.

All tubing is 1/4" TFE with 316 SS connections and PTFE ferrules. All wetted parts in the sampling chamber and gauges are either 316 SS, nickel, viton, or PTFE. Again, silicon rubber septa (Supelco Thermogreen™ LB-2) are used in place of PTFE-backed septa in both the chamber and column sampling ports. Columns A & C contained wood-based GAC from Westvaco, screened to a 10 x 14 standard mesh size. Coal-based GAC from Calgon Carbon with the same mesh size was packed in Columns B, D & E. The carbon loading in each column is listed in Table 1.

TABLE 1 Carbon Loading in Each Bio-Scrubber		
Column		Carbon Dosage (g)
A	Westvaco	87.3
B	Calgon	167.0
C	Westvaco	89.5
D	Calgon	165.0
E	Calgon	150.9

C. INOCULATION

Prior to 1992, the bio-scrubbers were operated successfully and steadily for a period of 3 months before the decay of the removal efficiency. Our diagnosis concluded that channeling of the air flow, drying of the filter media, and a poor inoculation procedure were the possible sources of the activity decline. An improved inoculation and maintenance procedure was developed, which led to a steady operation for >11 months. This improved inoculation is summarized as follows.

In the first quarter of 1992, five bio-scrubbers were re-inoculated. A new inoculation procedure was developed to solve the problem of air channeling in the carbon bed. A dilute benzoic acid solution, listed in Table 2, supported the growth of the biomass and allowed for impregnation without clogging the pore of the carbon. The inoculation procedure consisted of adding 100 ml of activated sludge, collected from a local sewage plant, to the benzoic acid media in batch mode and allowed to feed on its nutrients for 5 days before it was poured into the carbon columns. Biological growth in the inoculum was monitored visually insuring the success of the incubation. The biofilter was fed an ~10 ppm toluene/air mixture at the rate of 0.5 l/min during its five day incubation period. Table 3 shows the concentration history during the

TABLE 2 Benzoic Acid Media for Inoculation	
To 1L of Tap Water:	
Benzoic Acid C_6H_5COOH	500 ng/l
Ammonium Chloride (NH_4Cl)	139 ng/l
Sodium Metaphosphate [$(NaPO_3)_{13}Na_2O$]	25 ng/l
Sodium Metaphosphate ($NaHCO_3$)	3625

TABLE 3 COD History During Inoculation		
Initial COD for Influent (3/5/92)		
Column	COD (mg/l)	
A	> 1500	
B	> 1500	
C	> 1500	
D	> 1500	
E	> 1500	
COD Analysis for Effluent (3/6/92)		
Column	COD (mg/l)	
B	30	
D	25	
COD Analysis for Effluent (3/9/92)		
Column	COD (mg/l)	pH
A	470	6.2
B	25	8.24
D	55	8.3
E	20	7.7

incubation. The initial feed concentrations reached 550 mg/l; by the fifth day, column B had a COD concentration range of 2050 mg/L. Column influents remained in the range of 10 ppm with an occasional fluctuation approaching 30 ppm. All influent variation was corrected immediately without causing any alteration in column performance.

No toluene breakthrough was reported in the effluent of Columns A and C for the first 1.5 months of operation. The biomass supported on the GAC allowed the feed to be completely consumed with its 5 cm length from the influent to the first port. As shown in figure 4, operation of the bioscrubbers continued with complete toluene removal by Port C for all columns.

In addition, an inorganic nutrient was supplemented to the column for the inorganic requirement to sustain the bio-growth. The inorganic aqueous solution provides additional humidification of the contaminated air within the filter. The composition and flow rates were described in Table 4.

TABLE 4 Inorganic Nutrient	
To 1L of water:	
Ammonium Chloride (NH_4Cl)	769 mg/l
Sodium Metaphosphate [$(\text{NaPO}_3)_6 \cdot \text{Na}_2\text{O}$]	690 mg/l
Sodium Bicarbonate (NaHCO_3)	500 mg/l

D. RESULTS

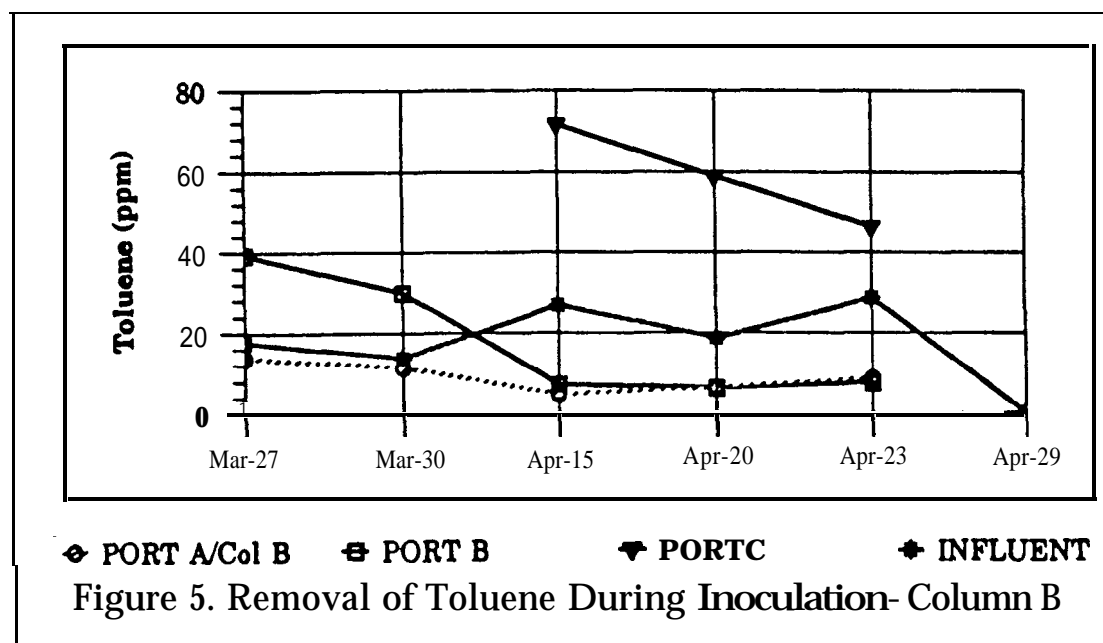
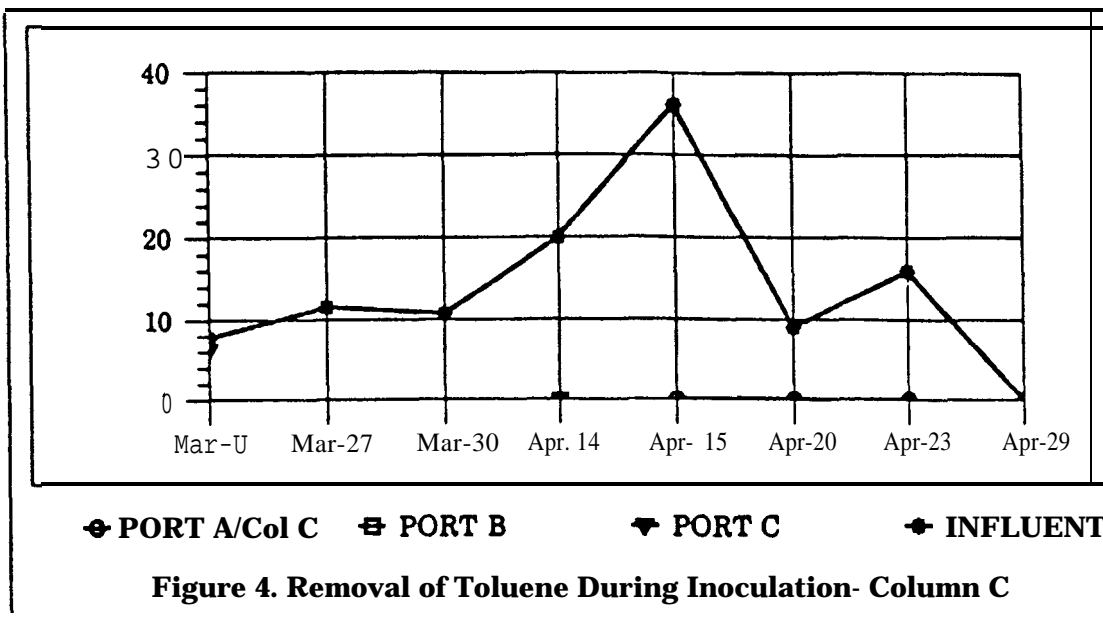
The columns consistently degraded the contaminant for a period of >11 months. They have achieved a > 95% removal efficiency within the first 5 to 10 inches of the carbon bed. A stationary mass transfer zone was observed with an empty bed contact time (EBCT) of 1 to 4 seconds depending on flow rates. This performance indicates the effectiveness and efficiency of the bioscrubbers developed in this program

1. Removal During Inoculation

Since the columns were pre-saturated with ~10 ppm of toluene in air prior to inoculation, the removal of toluene immediately after inoculation on 3/23/92 was attributed to the biodegradation of the microorganism inoculated on the carbon support. The roll-over of the pre-adsorbed toluene on the carbon was observed in Column C on 3/23 (Figure 4). Approximately 0 ppm of toluene was observed at Ports A & B; while about 6 ppm of toluene was observed at Port C with a feed concentration around 10 ppm on the same day. Evidently, the roll-over was resulted from desorption of the pre-adsorbed toluene along the axial direction of the column. The bio-digestion was not capable of degrading all toluene pre-adsorbed on the carbon, which then desorbed suddenly due to the new adsorption equilibrium established by the inoculum. Since no toluene was observed for Ports A & B, the removal of toluene by bio-degradation rather than carbon adsorption was obvious. A similar phenomenon was observed for Column B as shown in Figure 5. In this case, the roll-over declined and disappeared for a slightly longer period, i.e., ~2 weeks for Ports A & B and ~5 weeks for Port C. In conclusion, the removal of toluene by the bio-filter is evident based upon the roll-over phenomenon observed during the initial inoculation. In field start-up operation, no roll-over will be observed since the contaminants need not be pre-adsorbed and biodegradation will take place immediately.

2. Biodegradation Efficiency

Five columns have been operating since 3/23/92 until the present (February 1993). All columns were fed with 0.5 liters/minute of air containing ~10 ppm of toluene as a target concentration from 3/23 to 6/30/92. The actual feed concentration fluctuated from 5 to 40 ppm as shown in Figure 6-10, while most of the time it stayed between 10 to 20 ppm. During this period, no toluene breakthrough was observed at Port A, indicating the effective mass transfer zone was less than 5 inches, equivalent to > 19 g/M³/hr of biodegradation efficiency. More importantly, the mass transfer zone remained stationary for the entire period. Biodegradation of toluene evidently was effective and complete, showing no signs of accumulation of contaminants or the metabolic by-products. Bioregeneration of activated carbon has been discussed in the literature as a means to prolong the GAC service life in water and waste water treatment^{10,11}. This study extends the similar concept to air pollution control with the aid of a proper engineering design which offers a suitable environment for biogrowth.



3 Effect of Flow Rate

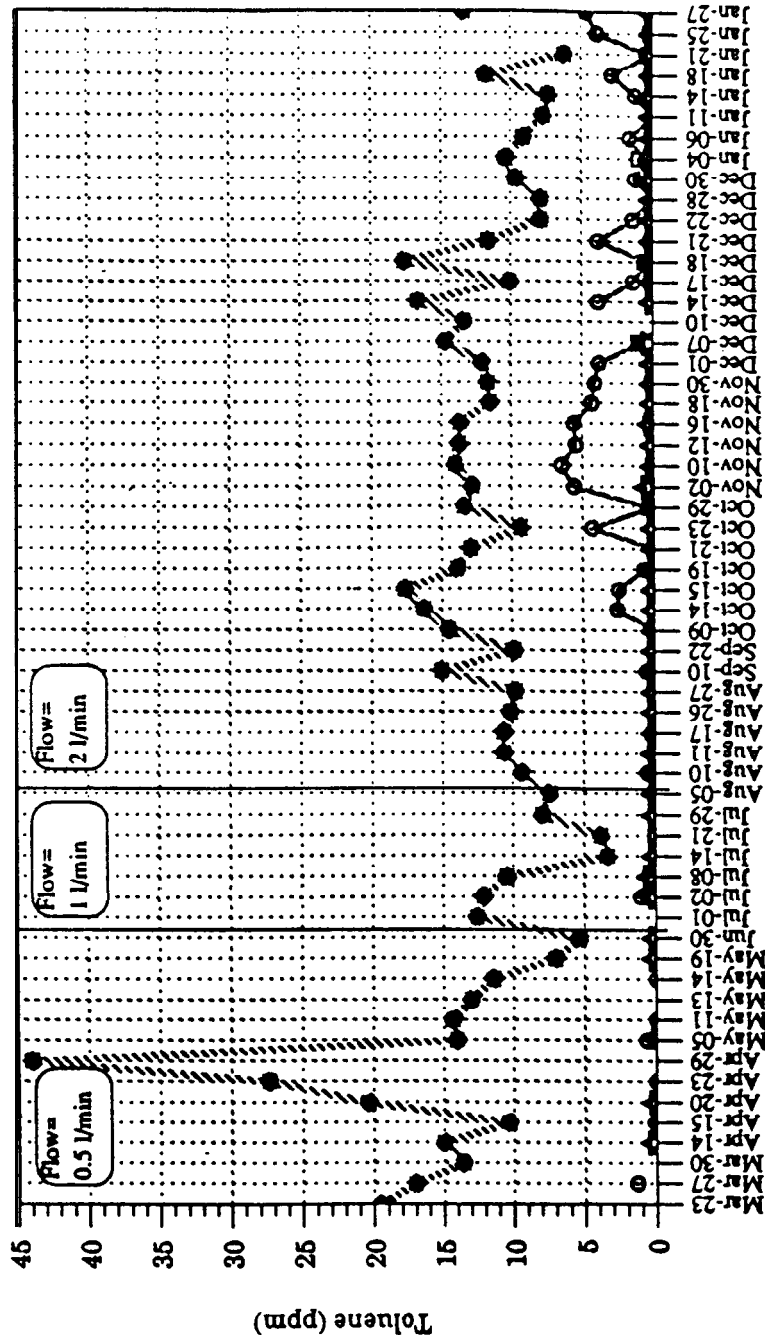
After the successful demonstration of the concept, several additional operating conditions were studied. The flow rates for Columns A and B were increased to 1 liter/minute and then 2 liters/minute (Figures 6 & 7) while Columns C, D & E remained at the original flow of 0.5 liter/minute (Figures 8, 9, & 10, respectively) to act as a control. The empty bed contact time (EBCT) under the 2 liter/minute flow rate is about 2 seconds. During this period (8/05 to 1/27/93 for Column A and 8/10/92 to 10/9/92 for Column B), both show some breakthrough ranging from 0 to 5 ppm at Port A (Figures 6 & 7). Nevertheless, no toluene was detected at Port B in each column. The effective mass transfer zone was estimated to be about 7.5 inches and remained stationary for the entire period. This efficiency was equivalent to 51 g/M³/hr of biodegradation of toluene. Column B was further challenged by increasing the flow rate to 4 liters/min, equivalent to 1 second of EBCT from 10/9/92 to 1/21/93. No contaminant breakthrough at Port B was observed for the majority of the experimental period. In certain instances, i.e., on December 30, 1992 and January 18, 1993, trace breakthroughs were observed, but the column rapidly recovered to its typical efficiency. The breakthroughs were possibly due to channeling of the flow. The mass transfer zone was estimated to be approximately 10 inches at this flow rate, equivalent to 80 g/M³/hr of toluene. The flow rate of Column B was subsequently reduced to 0.5 liters/minute on 1/21/93 no toluene breakthrough was detected at Port B as had been observed previously. The recovery of the column to the original mass transfer zone indicates that the increase of the mass transfer zone from 5 to 10" is possibly due to the degradation kinetics vs. linear velocity of the contaminant. Therefore, the mass transfer zone is concluded to be stationary throughout the entire study.

According to the literature, the degradation rate for toluene by existing biofilters is 20-30 g/M³/hr for concentrations ≥ 200 ppm. A nearly linear relationship between degradation rate vs. concentration was reported for concentrations <200 ppm. The performance observed in Columns A, B and C indicates a 40 to 80 times higher degradation rate than existing filters with naturally occurring media. This enhanced degradation is at least partially attributed to the adsorption function performed by the activated carbon medium.

Since no significant difference was observed between Columns A & C with a wood-based carbon and Columns B, D & E with a coal-based carbon for the entire operation period, it is believed that either carbon could deliver a similar performance under the testing conditions studied thus far. A long term study is required to assess the attrition loss of the carbon.

4. Feed Fluctuation

The biofilter adequately adsorbed fluctuations in the influent ranging from 0 to 45 ppm for the majority of the study. The fluctuation observed in the influent was not reflected in the analysis of Ports A and/or B, indicating that activated carbon effectively acted as a sink to adsorb the temporary concentration increases. This toluene "sink" was then, subsequently, digested by the microorganisms during normal operation and/or concentration in decreases.



◆ PORT A ⊕ PORT B ☆ PORT C ◆ INFLUENT

Figure 6. Removal of 10 ppm Toluene From Air With A Bioscrubber- Column A

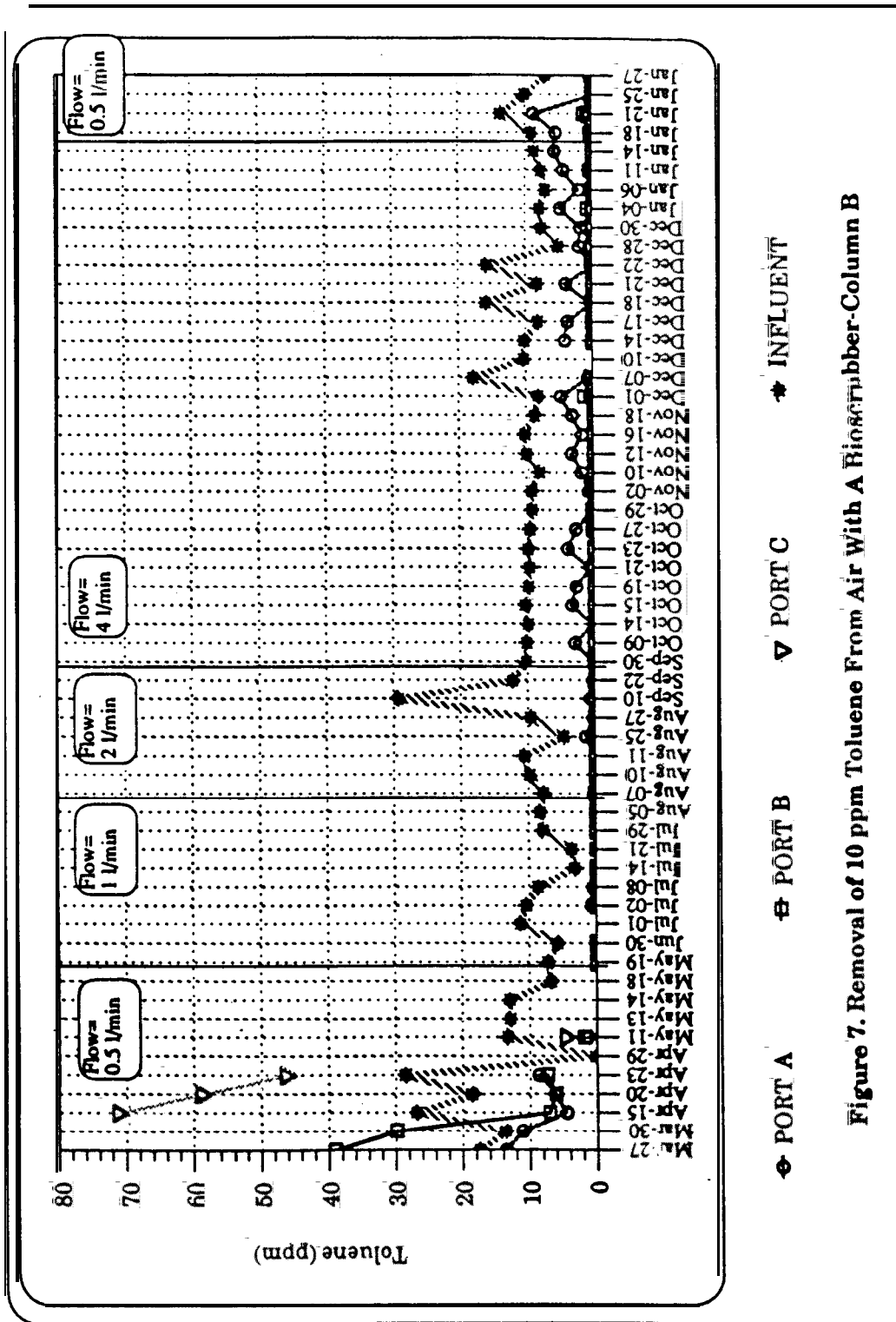
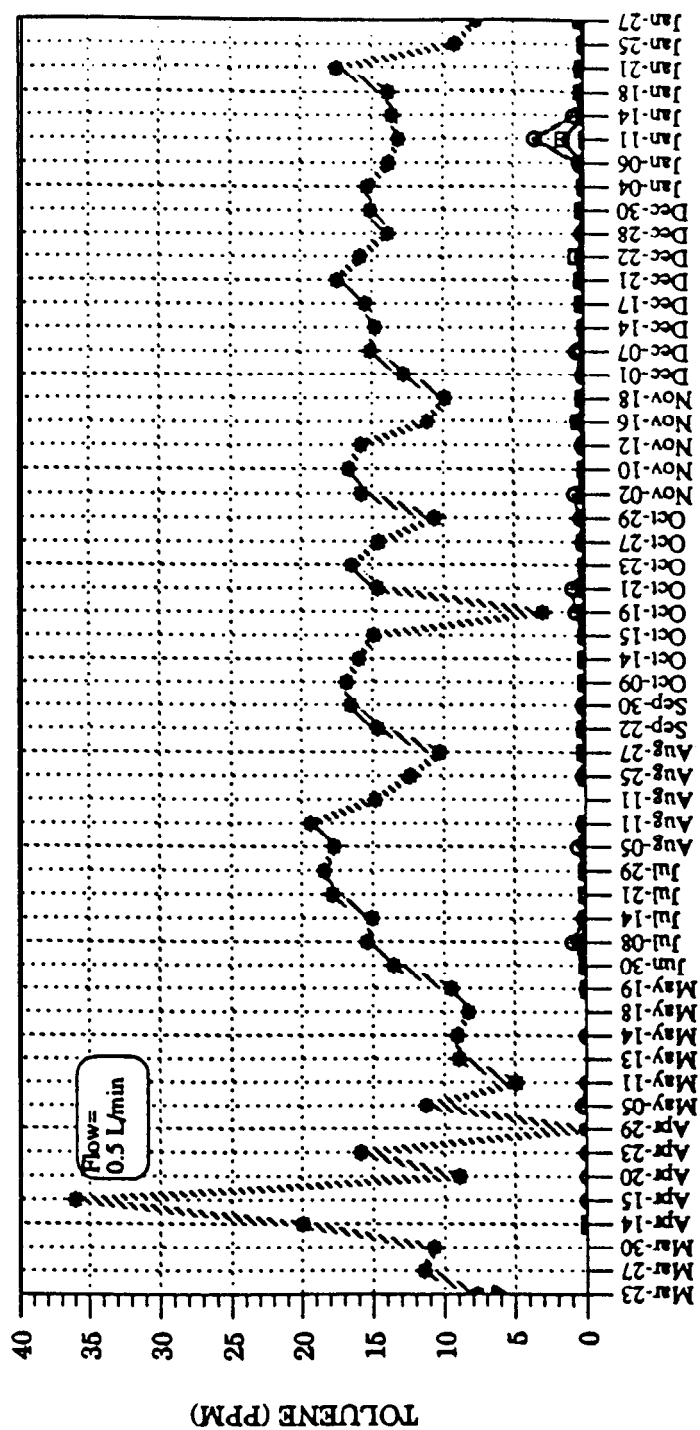


Figure 7. Removal of 10 ppm Toluene From Air With A Bioscrubber-Column B



Port A Port B Effluent Influent

Figure 8. Removal of 10 ppm Toluene Using A Bioscrubber-Column C

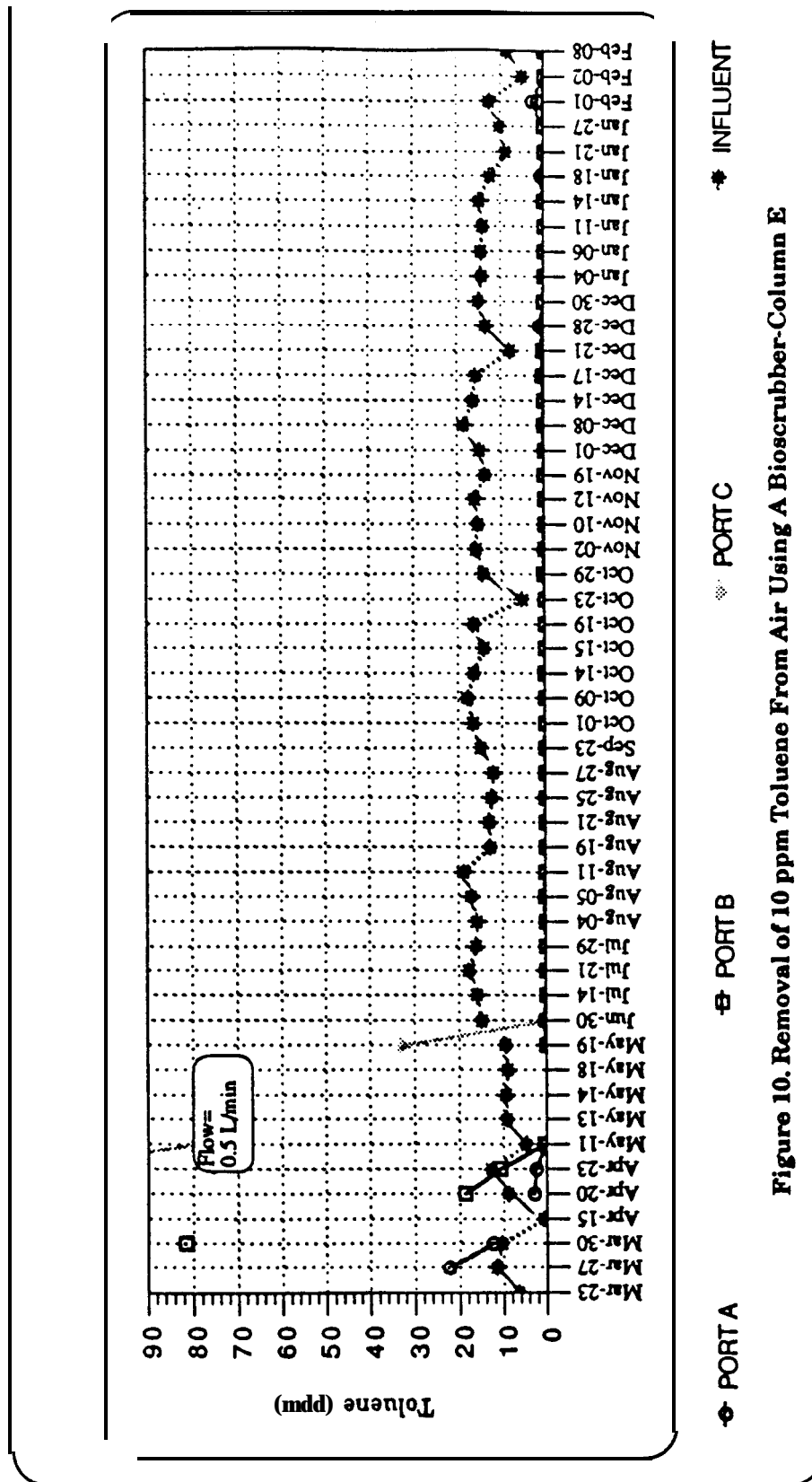


Figure 10. Removal of 10 ppm Toluene From Air Using A Bioscrubber-Column E

5. Pressure Drop and Bio-mass Build-up

The biomass generated and accumulated in the filter as a result of the degradation of contaminants was expected. Biomass was visually detected occupying the interparticle space. This build-up would essentially result in a pressure drop increase. Occasional removal of the biomass manually was practiced to maintain a minimal pressure drop throughout the operation period. While the excess biomass was removed from the column, sufficient amounts of biomass were retained on the carbon to maintain effective biodegradation when the bed was replaced. The biofilter efficiency was not reduced as a result of the biomass removal as indicated in Figures 6 to 10.

Pressure drop through the bio-scrubber is very minimal due to the shallow bed requirement to contain the stationary mass transfer zone. However, if the bio-mass build-up becomes significant, the pressure drop could increase dramatically and become an operational problem. Pressure drop experienced during the 11 months of operation is discussed in detail here.

Pressure drop experienced in Column C with a flow rate of 0.5 liter/min. is presented in Figure 11. The pressure drop measured here is the difference between the inlet and the outlet of the entire column, including the 25 inches of the packed column, the fittings, and entrance and exit effects. Initially the pressure drop throughout the entire column is \ll 10 inches of water until the end of June. Then the pressure drop increased significantly to the level of 60 and then 100 inches of water. After that, the pressure drop returned to the 10 to 20 inch level or even to close to 0 inches in January and February of 1993. It is believed that the turbulent pressure drop observed between July and September of 1992 resulted from the bio-mass' build-up in the inlet and channeling of the air flow in the presence of the aqueous nutrient trickling down the column. Since the build-up may be sloughed-off and/or the channeling may be rearranged, the pressure drop measured fluctuated significantly and at an unsteady state. The carbon from inlet to Port A was removed and washed to get rid of the bio-mass accumulation on October 21, 1992. The pressure drop since then has been maintained at < 20 inches of water. It is concluded that the pressure drop in a bioscrubber is very minimal, i.e., between 0 to 20 inches most of the time at the flow rate of 0.5 liters/min. The pressure drop could be reduced through the removal of the biomass accumulation in the carbon. This is one of the advantages of the engineered filter over the existing compost-type filter, where the compaction of the bed eventually develops and the replacement of the bed is required.

The pressure drop in Column B is presented in Figure 12. It shows that the pressure drop is between 5 to 15 inches for most of the time with the flow rate at 1 liter/minute. The pressure drop observed seemed not correlated with the flow rate increase from 1 to 2 and then 4 liters/min. In most of the period the pressure drop was between 0 to 20 inches along with the occasional washing of the carbon as indicated in the figure. The washing of the column was performed as necessary to maintain the low pressure drop in the column. Pressure drop in Column A showed a similar trend with the pressure drop observed ranging from 0 to 25 inches of water for most of the time (Figure 13). Occasional washing of the carbon may help in curtailing the increase of the pressure drop of the column.

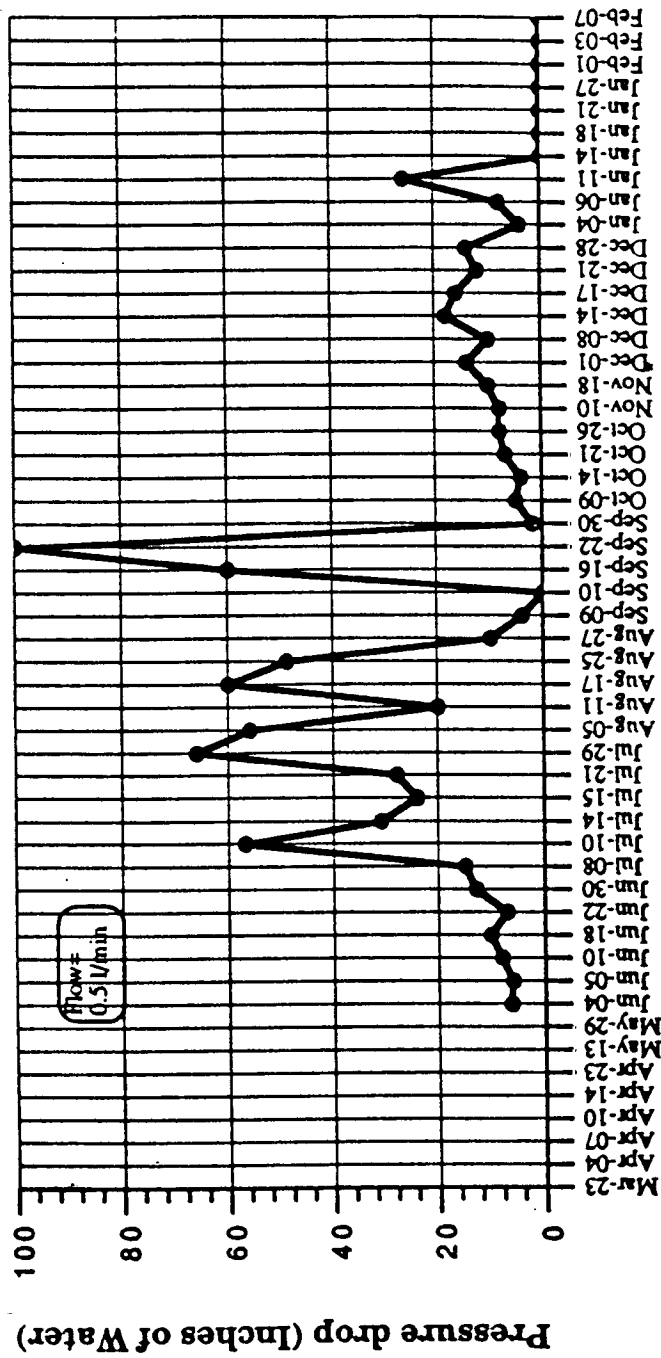


Figure 11. Pressure Drop of Column C During 3/25/92-2/7/93

• Date carbon was washed

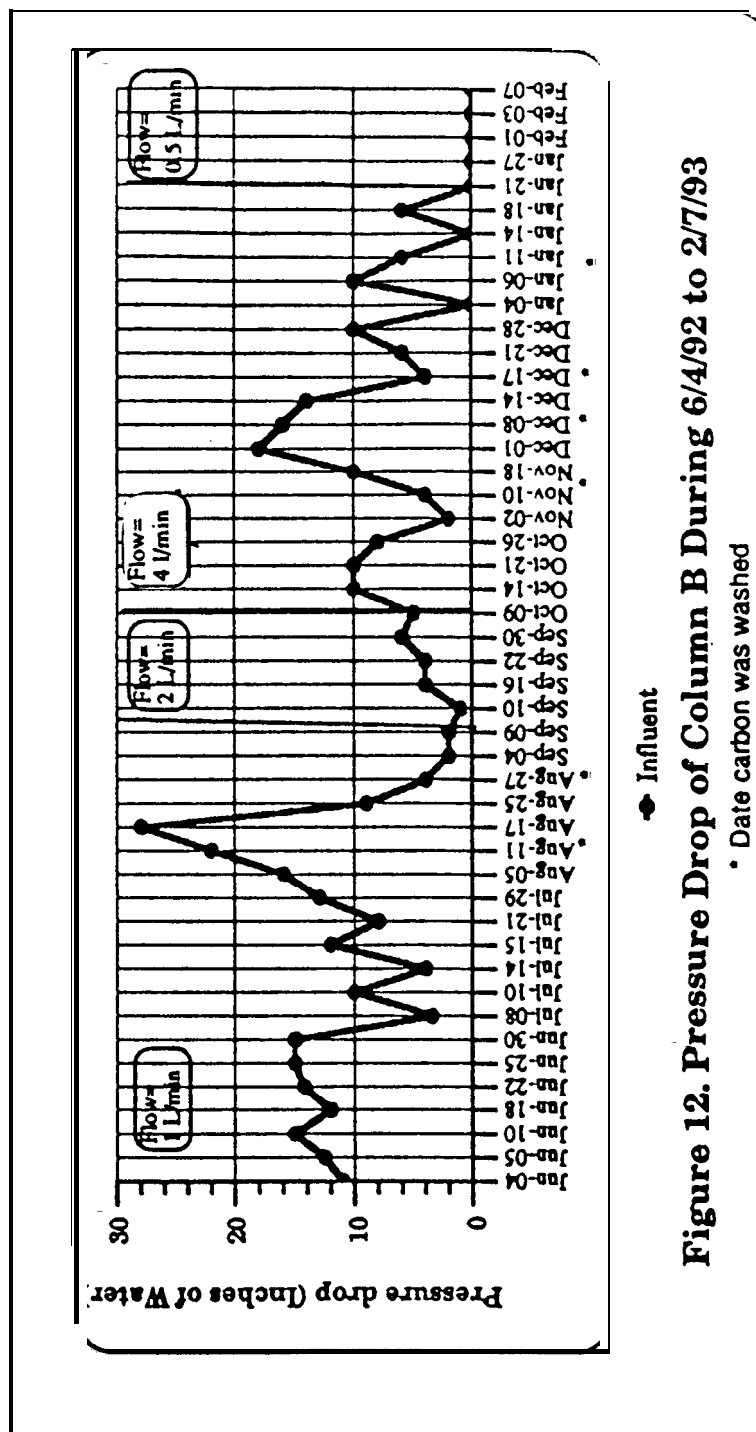


Figure 12. Pressure Drop of Column B During 6/4/92 to 2/7/93

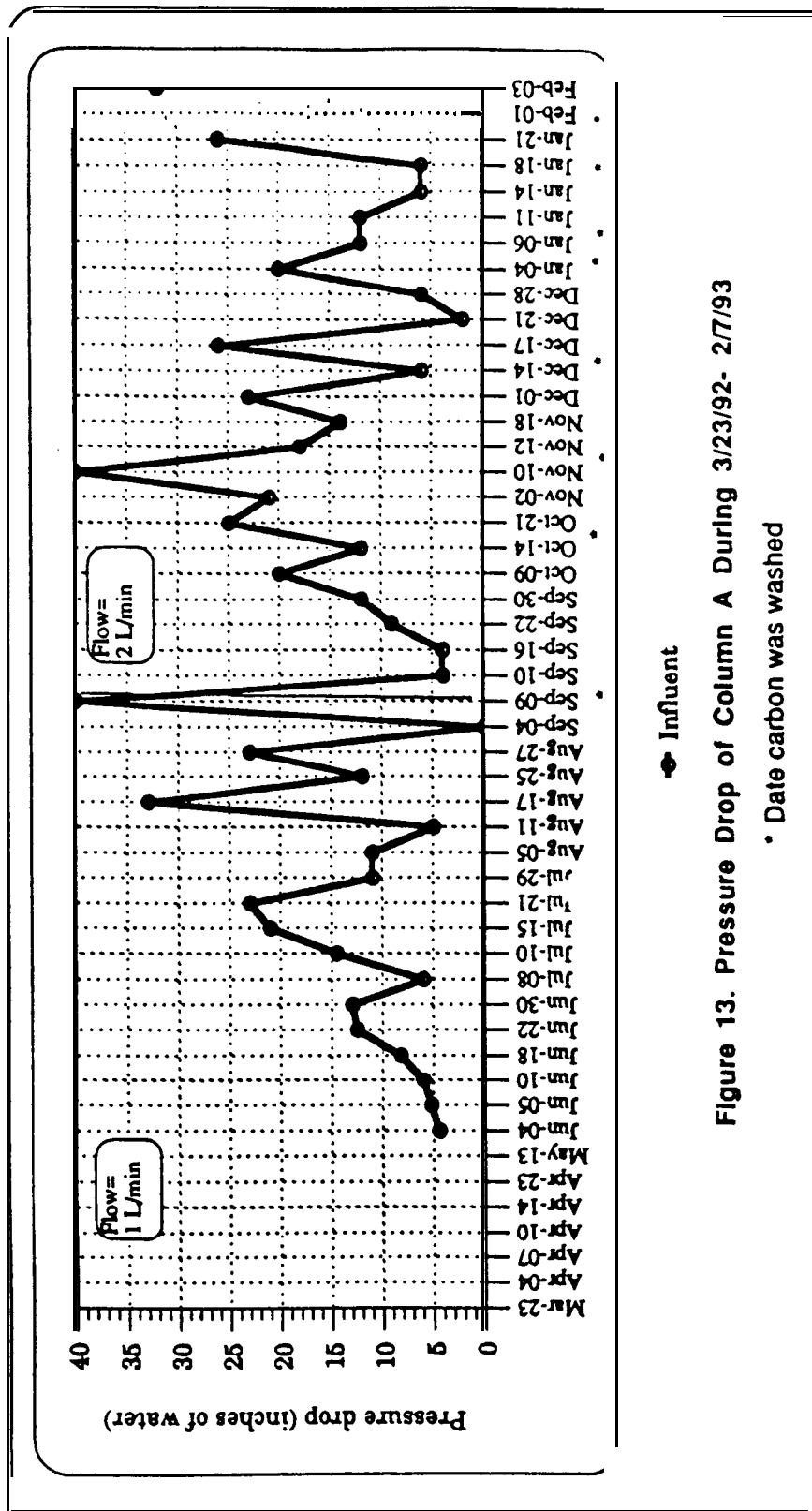


Figure 13. Pressure Drop of Column A During 3/23/92- 2/7/93

In summary, the pressure drop experienced in the bench-scale bio-scrubber ranged from 0 to 20 inches of water for most of the time for the flow rate from 0.5 to 4 liter/min. The pressure drop experienced here approximates the drop reported in the literature with a conventional media. The pressure drop is believed to be primarily attributed to the bio-mass build-up, which can be controlled via washing of the carbon. Occasional washing of the column as necessary was practiced in this study. An automatic washing device was designed for a field unit, which could deliver a much-reduced pressure drop..

V. PILOT UNIT

The pilot bioscrubber developed in this program is as simple as a carbon adsorber system incorporated with a nutrient delivery system and a biomass removal capability (Figures 14 & 15). Due to the simple configuration, it can be integrated into existing production processes or added downstream from existing remediation processes, such as air stripping towers, soil vacuum vents, biological wastewater treatment, etc. The system consists of four major components: (1) a gas delivery system, (2) the biofilter, (3) a nutrient delivery system and (4) a bio-mass removal system. Through our extended operating experience an advanced engineered and filtration technology has been incorporated into the pilot testing unit to become a reliable and user friendly biological treatment system. The gas delivery system sends the field gas stream from the customer's site to the unit via a gas distribution plate to ensure even distribution through the biofilter. Due to the short mass transfer zone in the biofilter, the bed depth requirement is very shallow and the need for a gas booster fan, if necessary at all, is minimal. Feed streams must be cooled to 100°F or less prior to entering the biofilter because the bacteria within the filter cannot be exposed to high temperatures. Other pre-treatment, such as particulate removal, may be necessary if substantial particulates are present in the feed. Due to the build-in bio-mass removal capability, the system can tolerate a higher particulate concentration than most existing filters.

The biofilter is a very shallow granular activated carbon adsorber. The microbes are inoculated onto the carbon surface, which usually takes about 2 weeks during start-up in order to ensure a sufficient microbial population. Bed-depth of ~2 feet and EBCT of 1 to 4 seconds are normally required to ensure the confinement of the mass transfer zone of the contaminant within the bed. The actual dimensions may vary depending upon the feed concentration and its biodegradability.

An automatic nutrient delivery system is part of the advanced engineering package of the pilot unit. The feed stream contaminants provide the primary organic carbon source for biogrowth, however, inorganic nutrients are also required for optimal growth. A unique nutrient delivery system with recirculation has been implemented to provide proper inorganic nutrients with no secondary pollution. Nitrogen and phosphate are mixed into a solution and automatically delivered to the biofilter at preset intervals. The system is flexible in supplementing additional organic nutrients to (1) maintain the biofilter during an extended downtime, or (2) enhance degradation for recalcitrant contaminants via co-metabolism.

Figure 14. Pilot-Scale BioScrubber Unit

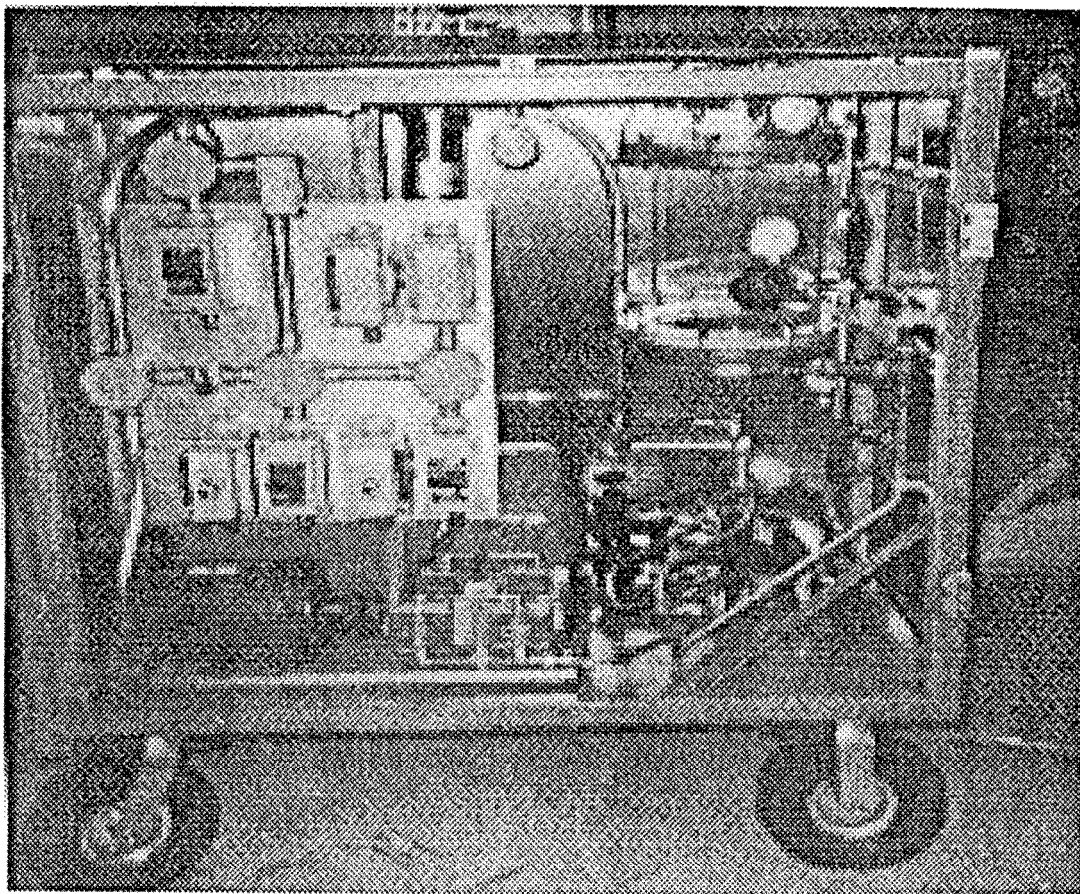
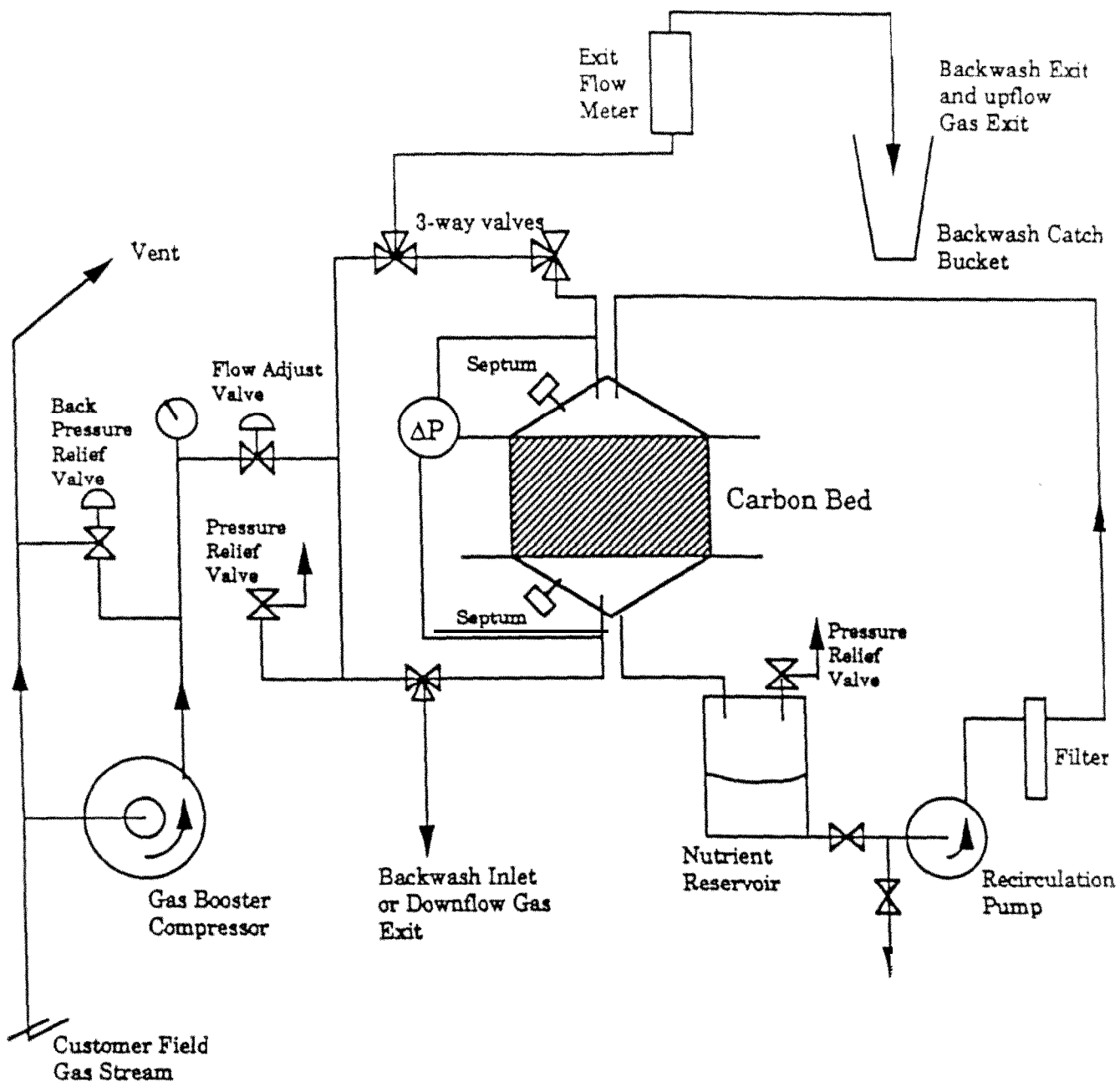


Figure 15. Bio-Scrubber Field Unit Flow Diagram



The bio-mass removal device is one of the unique features of the developed biofilter, which differentiates ours from existing biofilters. The device introduces aqueous backwashing via a high pressure nozzle to discharge the excess bio-mass periodically out of the biofilter. The discharge is further filtered before discharging into the local sewage treatment system. Due to the extreme efficiency of the bio-degradation, no additional post-treatment of the aqueous discharge is expected.

In summary, the developed pilot testing unit offers a unique engineering design to make biological treatment a simple and reliable operation, which is often perceived as an extensive 'baby-sitting' operation in the waste treatment community. In addition, the utilization of an activated medium as a bio-filter media enhances the bio-degradation efficiency, which minimizes filter dimensions and reduces capital and operating costs.

VI. QUALITY ASSURANCE

Toluene concentration was determined by gas chromatography. The methodology, calibration curve and method of detection limit are detailed below:

A. Calibration Curve

The following data were obtained by injecting fixed volumes of certified standard gas mixtures (Matheson Gas Products) (see Appendix A) into an HP 5995 GC/MS equipped with an HP 18965A FID detector.

TABLE 5 Calibration of Standard Gas Mixtures of Toluene			
Data			
Sample	Peak Area	Mean Area	% RSD
1.0 ppm	33107		
	35106		
	34774	34329	3.1
10.0 ppm	413830		
	415940		
	419240	416337	0.6
20.0 ppm	739740		
	756670		
	748300	748236	1.1
Linear regression of these three points yields a correlation coefficient of <u>0.9974</u> .			
With an area rejection value of 0.0, the regression yields a correlation of' <u>0.9982</u> .			

Conditions Used

1. **Column:** 6' x 1/8" SS packed with 5% SP 1200, 1.75% Bentone 34 on 100/200 Supelcoport.
2. **Oven Temperature Program** 75°C isothermal
3. **Injection Port Temperature:** 200°C
4. **FID Temperature:** 200°C
5. **Carrier Gas:** Helium at 20 scc/min
6. **Injection Volume:** 500 µl

Calibration standards consisted of 1.0, 10.0 and 20.0 ppm toluene in hydrocarbon free air. Calibration standards were purchased for purity and all standards were verified by the USEPA audit standards when available. Accuracy is certified by the supplier to $\pm 5\%$ of the specific component. Concentration tolerance is $\pm 20\%$. Calibration was verified on a daily basis through the analysis of a 10 ppm standard. If the determined concentration differed from the previous calibration value by more than 5%, the source of error was detected, corrected and noted.

In April, 1992, the analysis was switched to a Varian (Model 3400) Gas Chromatograph equipped with a signal integrator compatible with a flame ionization detector (FID) output. The Varian oven is capable of maintaining an isothermal 75°C ± 1.0 and an injection port temperature of 200°C. 500 µl samples were extracted in a 1000 µl (application range 0.1-40 ppm) gas tight syringe were injected onto 60/80 Carbopack B, 1% SP-1000 column with a detection limit of 0.1 ppm. Compressed gases running through the system consisted of zero grade air and ultra-high purity helium and hydrogen.

Column conditioning was conducted by heating the column for a minimum of 18 hours at 25-50°C below the maximum packing temperature with carrier flow and vented to atmosphere. After cooling the column to ambient temperature, the carrier flow was shut off. After 15 minutes, the column was connected to the detector inlet with suitable fittings and checked for leaks.

After conditioning, the hydrogen and air flow were adjusted according to the manufacturer's specifications for the column. Column temperature and carrier flow were adjusted to the desired operating levels and the FID was ignited according to the manufacturers instructions. The baseline output was monitored with a recording device until the signal drift was equilibrated.

The toluene peak appears typically between 3.55 to 3.60 minutes. Calibration curves can be generated from measured area or height of standard peaks obtained from a strip chart recorder or direct integrator quantitation. In our case, response factors for calibration standards were entered into a Varian (model 4270, Figure 4) integrator for direct quantitation of the toluene samples.

The syringe was filled using a septum bag. Samples were injected and analyzed according to the calibration curve. If duplicate sample data was required, the sample was not taken directly from the septum port, but collected in a Tedlar bag.

B Sampling

A 500 μ l gas-tight syringe was purged with air first and the microvalve at the end of the syringe was then closed. The syringe was inserted through the septum of the 1.0 ppm standard Tedlar bag. The valve on the syringe was opened. The syringe was then filled and purged three times. The syringe was filled with the sample a fourth time and the valve was closed. The needle was inserted into the port of the GC. The microvalve was reopened and the sample was injected. This process was repeated three times for the 1 ppm standard as well as the 10 and 20 ppm standards.

C. Method Detection Limit

The method detection limit (MDL) is defined as the value obtained when the standard deviation of the instrument noise is factored by three and divided by the slope of the calibration curve. The slope of the calibration curve is easily obtained. With "modern" integration equipment, this slope is usually defined as the ratio of the peak area and the concentration. Unfortunately, it is difficult to correlate an absolute noise level (μ V) with this calculated slope. In addition, the document defines the instrument noise as being "adjacent in retention time" to the analyte peak. In practice, this value is difficult to obtain with the configured integration equipment. In an effort to overcome these difficulties, the following procedures were employed to obtain compatible instrument noise and calibration slope values.

Instrument Noise

The average instrument noise was plotted prior to injection at very low attenuation (full scale = 32 μ V; see plot A of Figure 16).

The instrument noise "adjacent in retention time" was determined by subtracting absolute detector output values obtained during calibration runs from the stable detector output prior to the injections. Eighteen (18) μ V values were averaged over three runs (see plots C, D, and E of Figure 15). B is a plot without an injection at the same attenuation.

Calibration Slope

Three calibration runs were made in peak height mode using a 10 ppm calibration standard (see plots C, D, and E). The peak heights of the three toluene peaks were averaged and converted to an absolute μ V value. The slope of the line was calculated from this average μ V value.

GC Conditions

1. Column: 6' x 1/8" SS packed with 5% SP 1200, 1.75% Bentone 34 on 100/200 Supelcoport.
2. Oven Temperature Program 75'C isothermal
3. Injection Port Temperature: 200'C
4. FID Temperature: 200'C
5. Carrier Gas: Helium at 20 scc/min
6. Injection Volume: 500 μ l

Data

1. Average instrument noise (from plot A) = 16 μ v
2. "Adjacent" instrument noise from plots C, D, and E)

<u>Run</u>	<u>Pre-injection (μv)</u>	<u>During run (μv)</u>	
C	500	510	10
		510	10
		540	40
		530	30
		540	40
		540	40
		540	40
	440	450	10
		460	20
		460	20
		460	20
	460	470	10
		480	20
		490	30
		500	40
		500	40
		500	40
		500	40

Average Δ = 28 μ v

σ_{n-1} = 13 μ v

3 x σ_{n-1} = 39 μ v

Calibration slope

	<u>Run</u>	<u>Peak height (counts)</u>
	C	36666
	D	35685
	E	35423
Average height	=	35925 counts
σ_{n-1}	=	655 counts
Relative σ_{n-1}	=	0.018
Average height (μV)	=	$\sim 35925 \text{ counts} \times 0.129 \mu\text{V/count}^*$
	=	4635 μV
Slope ($\mu\text{V}/\text{mg/l}$)	=	$4635 \mu\text{V}/10 \text{ mg/l}$
	:	463.5 $\mu\text{V}/\text{mg/l}$

Method detection limit (MDL)

$$\begin{aligned}\text{MDL} &= 3 \times \sigma_{n-1} / \text{slope} \\ &= 39 \mu\text{V} / 463.5 \mu\text{V}/\text{mg/l} \\ &= 0.084 \text{ mg/l}\end{aligned}$$

VII. REFERENCES

1. H. L. Bohn, and R. K. Bohn, "Soil Bed Scrubbing of Fugitive Gas Releases", J. Environ. Sci. Health, A21(6), 561-569 (1986).
2. W. H. Prokop, and K. L. Bohn, "Soil Bed System for Control of Rendering Plant Odors", J. Air Pollut. Control Assoc., 35, 1332, (1985).
3. R. D. Pomeroy, "Controlling Sewage Plant Odors", Consulting Engineer, 20, 101, (1963)
4. S. Anso, "Odor Control of Waste Water Treatment Plants", J. Water Pollut. Control Fed., 52, 906, (1980).
5. D. A. Carlson, and C. P. Leiser, "Soil Beds for the Control of Sewage Odors", J. Water Pollution Control Assoc., 38, 829, (1966).
6. D. H. Kampbell, J. T. Wilson, and H. W. Read, "Removal of Volatile Aliphatic Hydrocarbons in a Soil Bioreactor", J. Air Pollut. Control Assoc., 37, 1236, (1987).
7. M. H. Ebinger, H. L. Bohn, and R. W. Puls, "Propane Removal from Propane-Air Mixtures by Soil Beds", J. Air Pollut. Control Assoc., 37, 12, 1486-1489, (1987).
8. H. L. Bohn, "Soil and Compost Filters of Malodorous Gases", J. Air Pollut. Control Assoc., 25, 953, (1975).
9. G. Leson and A. M. Winer, "Biofiltration: An Innovative Air Pollution Control Technology for VOC Emissions", Air and Waste Management Assoc. 41 (8): 1045-1054 (1991-L)
10. G. E. Speitel, Jr., F. A. DiGiano, "The bioregeneration of GAC used to Treat Micropollutants", J. Am. Water Works Assoc., 79(1), 64-73, (1987)
11. J. G. Goeddertz, M. R. Matsumoto, A. S. Weber, "Offline Bioregeneration of Granular Activated Carbon", J. Environ. Eng., 114(5), 1063-76.

APPENDIX A

DATA COLLECTED

Code	Description	Date	Analysis (Toluene, ppm)
10PPMSTD	Standard	13-Apr-92	9.2405
10PPMSTD	Standard	13-Apr-92	9.1889
10PPMSTD	Standard	13-Apr-92	9.0212
BLANK	Blank	13-Apr-92	0.0000
1PPMSTD	Standard	13-Apr-92	0.0000
1PPMSTD	Standard	13-Apr-92	0.0000
10PPMSTD	Standard	14-Apr-92	10.0000
10PPMSTD	Standard	14-Apr-92	9.1149
10PPMSTD	Standard	14-Apr-92	9.5990
1PPMSTD	Standard	14-Apr-92	0.8549
1PPMSTD	Standard	14-Apr-92	0.7795
1PPMSTD	Standard	14-Apr-92	0.8294
BLANK	Blank	14-Apr-92	0.0000
A(CPORT)	Col A, C Port	14-Apr-92	0.0856
C(CPORT)	Col C, C Port	14-Apr-92	0.0000
INFA4/14	Influent, Col A	14-Apr-92	14.9470
INFC4/14	Influent, Col C	14-Apr-92	19.9480
10PPM	Standard	15-Apr-92	9.9174
10PPM	Standard	15-Apr-92	9.9057
10PPM	Standard	15-Apr-92	9.4514
1PPM	Standard	15-Apr-92	0.8555
1PPM	Standard	15-Apr-92	0.8191
1PPM	Standard	15-Apr-92	0.7995
INFA4/15	Influent, Col A	15-Apr-92	10.2860
INFB4/15	Influent, Col B	15-Apr-92	26.8990
INFC4/15	Influent, Col C	15-Apr-92	36.0050
INFD4/15	Influent, Col D	15-Apr-92	33.2100
INFE4/15	Influent, Col E	15-Apr-92	0.7040
A(APORT)	Col A, A Port	15-Apr-92	0.1407
C(APORT)	Col C, A Port	15-Apr-92	0.0000
B(APORT)	Col B, A Port	15-Apr-92	4.5640
B(BPORT)	Col B, B Port	15-Apr-92	7.0751
D(APORT)	Col D, A Port	15-Apr-92	40.1320
D(BPORT)	Col D, B Port	15-Apr-92	146.6800
BLANK	Blank	15-Apr-92	0.3861
E/INF	Col E, Influent	15-Apr-92	0.7129
B(CPORT)	Col B, C Port	15-Apr-92	71.5290
D(CPORT)	Col D, C Port	15-Apr-92	381.9600
1PPMSTD	Standard	20-Apr-92	0.8159
1PPMSTD	Standard	20-Apr-92	0.7775
1PPMSTD	Standard	20-Apr-92	0.7599
10PPMSTD	Standard	20-Apr-92	9.4093
10PPMSTD	Standard	20-Apr-92	9.6124
10PPMSTD	Standard	20-Apr-92	9.4784
B/INF	Col B, Influent	20-Apr-92	18.5710
C/INF	Col C, Influent	20-Apr-92	8.9199
D/INF	Col D, Influent	20-Apr-92	9.7241
E/INF	Col E, Influent	20-Apr-92	8.8132
A/INF	Col A, Influent	20-Apr-92	20.3290
A(APORT)	Col A, A Port	20-Apr-92	0.0000
C(APORT)	Col C, A Port	20-Apr-92	0.0000
B(APORT)	Col B, A Port	20-Apr-92	6.2683
B(BPORT)	Col B, B Port	20-Apr-92	6.1374
D(APORT)	Col D, A Port	20-Apr-92	14.4520
D(BPORT)	Col D, B Port	20-Apr-92	88.6860

Code	Description	Date	Analysis (Toluene, ppm)
E(APORT)	Col E, A Port	20-Apr-92	2.9836
E(BPORT)	Col E, B Port	20-Apr-92	18.8160
E(CPORT)	Col E, C Port	20-Apr-92	138.2400
D(CPORT)	Col D, C Port	20-Apr-92	356.5300
B(CPORT)	Col B, C Port	20-Apr-92	58.8510
10PPMSTD	Standard	23-Apr-92	9.8798
10PPMSTD	Standard	23-Apr-92	9.7551
10PPMSTD	Standard	23-Apr-92	9.7765
20PPMSTD	Standard	23-Apr-92	18.2110
20PPMSTD	Standard	23-Apr-92	18.2080
20PPMSTD	Standard	23-Apr-92	17.8140
BLANK	Blank	23-Apr-92	0.0000
A/INF	Col A, Influent	23-Apr-92	27.3450
B/INF	Col B, Influent	23-Apr-92	28.5090
C/INF	Col C, Influent	23-Apr-92	15.8540
D/INF	Col D, Influent	23-Apr-92	30.0700
E/INF	Col E, Influent	23-Apr-92	12.7070
A(APORT)	Col A, A Port	23-Apr-92	0.0000
C(APORT)	Col C, A Port	23-Apr-92	0.0000
B(APORT)	Col B, A Port	23-Apr-92	8.6619
B(BPORT)	Col B, B Port	23-Apr-92	7.4386
D(APORT)	Col D, A Port	23-Apr-92	16.0100
D(BPORT)	Col D, B Port	23-Apr-92	76.3080
E(APORT)	Col E, A Port	23-Apr-92	2.4400
E(BPORT)	Col E, B Port	23-Apr-92	10.8140
E(CPORT)	Col E, C Port	23-Apr-92	118.0100
D(CPORT)	Col E, C Port	23-Apr-92	348.2600
B(CPORT)	Col B, C Port	23-Apr-92	46.3540
Blank	Blank	29-Apr-92	0.0000
10PPMSTD	Standard	29-Apr-92	9.5510
10PPMSTD	Standard	29-Apr-92	9.1458
10PPMSTD	Standard	29-Apr-92	8.9574
A/INF	Col A, Influent	29-Apr-92	0.1748
B/INF	Col B, Influent	29-Apr-92	0.1407
C/INF	Col C, Influent	29-Apr-92	0.0000
10PPMSTD	Standard	30-Apr-92	9.9145
10PPMSTD	Standard	30-Apr-92	9.5583
10PPMSTD	Standard	30-Apr-92	9.6836
BLANK	Blank	30-Apr-92	0.0000
BLANK	Blank	4-May-92	0.0000
BLANK	Blank	5-May-92	0.0000
10PPM	Standard	5-May-92	10.2240
10PPM	Standard	5-May-92	9.9114
A/INF	Col A, Influent	5-May-92	16.4980
C/INF	Col C, Influent	5-May-92	18.5270
A(APORT)	Col A, A Port	5-May-92	0.6684
A(BPORT)	Col A, B Port	5-May-92	0.0000
C(APORT)	Col C, A Port	5-May-92	0.3242
C(BPORT)	Col C, B Port	5-May-92	0.0000
A/INF	Col A, Influent	5-May-92	14.8460
A/INF	Col A, Influent	5-May-92	14.6740
A/INF	Col A, Influent	5-May-92	14.0330
C/INF	Col C, Influent	5-May-92	11.4070
C/INF	Col C, Influent	5-May-92	11.6410
C/INF	Col C, Influent	5-May-92	11.2760

Code	Description	Date	Analysis (Toluene, ppm)
10PPM	Standard	11-May-92	9.3028
10PPM	Standard	11-May-92	8.9092
10PPM	Standard	11-May-92	8.9012
20PPM	Standard	11-May-92	16.0450
20PPM	Standard	11-May-92	17.0650
AINF	Col A, Influent	11-May-92	13.9870
AINF	Col A, Influent	11-May-92	14.3040
CINF	Col C, Influent	11-May-92	4.8154
CINF	Col C, Influent	11-May-92	4.9299
DINF	Col D, Influent	11-May-92	5.0239
DINF	Col D, Influent	11-May-92	5.0492
EINF	Col E, Influent	11-May-92	4.9287
EINF	Col E, Influent	11-May-92	4.7102
BINF	Col B, Influent	11-May-92	13.1490
BINF	Col B, Influent	11-May-92	13.2380
A(APORT)	Col A, A Port	11-May-92	0.0000
C(APORT)	Col C, A Port	11-May-92	0.0000
B(APORT)	Col B, A Port	11-May-92	1.4136
B(BPORT)	Col B, B Port	11-May-92	1.8042
D(APORT)	Col D, A Port	11-May-92	2.0983
D(BPORT)	Col D, B Port	11-May-92	8.2579
E(APORT)	Col E, A Port	11-May-92	0.2375
E(BPORT)	Col E, B Port	11-May-92	0.4896
E(CPORT)	Col E, C Port	11-May-92	79.5880
D(CPORT)	Col D, C Port	11-May-92	216.5400
B(CPORT)	Col B, C Port	11-May-92	4.6168
BLANK	Blank	13-May-92	0.0000
10PPM	Standard	13-May-92	9.3149
10PPM	Standard	13-May-92	8.9068
10PPM	Standard	13-May-92	9.2705
BLANK	Blank	13-May-92	0.0000
CINF	Col C Influent	13-May-92	9.0279
CINF	Col C Influent	13-May-92	8.9544
BINF	Col B Influent	13-May-92	12.3670
BINF	Col B Influent	13-May-92	12.8970
DINF	Col D Influent	13-May-92	9.3203
DINF	Col D Influent	13-May-92	9.2198
EINF	Col E Influent	13-May-92	9.1023
EINF	Col E Influent	13-May-92	9.2019
AINF	Col A Influent	13-May-92	13.0560
AINF	Col A Influent	13-May-92	13.0200
BLANK	Blank	14-May-92	0.0000
10PPM	Standard	14-May-92	9.3310
10PPM	Standard	14-May-92	8.9369
10PPM	Standard	14-May-92	8.8609
AINF	Col A Influent	14-May-92	10.8820
AINF	Col A Influent	14-May-92	11.3940
CINF	Col C Influent	14-May-92	8.9758
CINF	Col C Influent	14-May-92	9.0491
DINF	Col D Influent	14-May-92	9.7807
DINF	Col D Influent	14-May-92	9.1013
EINF	Col E Influent	14-May-92	8.9273
EINF	Col E Influent	14-May-92	9.2877
BINF	Col B Influent	14-May-92	13.7610
BINF	Col B Influent	14-May-92	12.9850

Code	Description	Date	Analysis (Toluene, ppm)
A(APORT)	Col A, A Port	14-May-92	0.0000
C(APORT)	Col C, A Port	14-May-92	0.0000
BLANK	Blank	18-May-92	0.0000
10PPM	Standard	18-May-92	8.8392
10PPM	Standard	18-May-92	9.1629
10PPM	Standard	18-May-92	8.7197
CINF	Col C Influent	18-May-92	8.3229
DINF	Col D Influent	18-May-92	8.7544
EINF	Col E Influent	18-May-92	8.9791
BINF	Col B Influent	18-May-92	6.7465
BLANK	Blank	19-May-92	0.0000
10PPM	Standard	19-May-92	9.0211
10PPM	Standard	19-May-92	9.0157
10PPM	Standard	19-May-92	8.9499
BINF	Col B Influent	19-May-92	7.2867
CINF	Col C Influent	19-May-92	9.4873
DINF	Col D Influent	19-May-92	9.6635
EINF	Col E Influent	19-May-92	9.4424
AINF	Col A Influent	19-May-92	7.0294
C(APORT)	Col C, A Port	19-May-92	0.0000
A(APORT)	Col A, A Port	19-May-92	0.0000
B(APORT)	Col B, A Port	19-May-92	0.0000
B(BPORT)	Col B, B Port	19-May-92	0.0000
D(APORT)	Col D, A Port	19-May-92	0.0000
D(BPORT)	Col D, B Port	19-May-92	0.0000
E(APORT)	Col E, A Port	19-May-92	0.0000
E(BPORT)	Col E, B Port	19-May-92	0.0000
E(CPORT)	Col E, C Port	19-May-92	32.5560
D(CPORT)	Col D, C Port	19-May-92	21.2600
B(CPORT)	Col B, C Port	19-May-92	0.0000
C(CPORT)	Col C, C Port	19-May-92	0.0000
A(CPORT)	Col A, C Port	19-May-92	0.0000
1PPM	Standard	28-May-92	1.0553
1PPM	Standard	28-May-92	0.9855
1PPM	Standard	28-May-92	1.0151
10PPM	Standard	28-May-92	6.9289
20PPM	Standard	28-May-92	22.6690
AIN/PID	Standard	29-May-92	11.2330
AIN/PID	Standard	29-May-92	10.0620
10PPMSTD	Standard	29-May-92	12.6950
BLANK	Blank	22-Jun-92	0.0000
1PPMSTD	Standard	22-Jun-92	0.0000
1PPMSTD	Standard	22-Jun-92	1.1387
1PPMSTD	Standard	22-Jun-92	1.1687
1PPMSTD	Standard	22-Jun-92	1.1520
A(INF)	Col A, Influent	22-Jun-92	7.3763
B(INF)	Col B, Influent	22-Jun-92	7.4888
C(INF)	Col C, Influent	22-Jun-92	18.0040
D(INF)	Col D, Influent	22-Jun-92	17.4120
E(INF)	Col E, Influent	22-Jun-92	18.7190
E(APORT)	Col E, A Port	22-Jun-92	0.6072
E(BPORT)	Col E, B Port	22-Jun-92	0.0000
D(APORT)	Col D, A Port	22-Jun-92	0.0000
D(BPORT)	Col D, B Port	22-Jun-92	0.0000
C(APORT)	Col C, A Port	22-Jun-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
C(BPORT)	Col C, B Port	22-Jun-92	0.0000
B(APORT)	Col B, A Port	22-Jun-92	0.0000
B(BPORT)	Col B, B Port	22-Jun-92	0.0000
A(APORT)	Col A, A Port	22-Jun-92	0.0000
A(BPORT)	Col A, B Port	22-Jun-92	0.0000
1PPMSTD	Standard	29-Jun-92	1.1874
1PPMSTD	Standard	29-Jun-92	1.1967
1PPMSTD	Standard	29-Jun-92	1.2166
1PPMSTD	Standard	29-Jun-92	0.0000
BLANK	Blank	29-Jun-92	0.0000
BLANK	Blank	29-Jun-92	0.0000
A(CPORT)	Col A, C Port	30-Jun-92	0.0000
A(BPORT)	Col A, B Port	30-Jun-92	0.0000
A(APORT)	Col A, A Port	30-Jun-92	0.0000
B(CPORT)	Col B, C Port	30-Jun-92	0.0000
BLANK	Blank	30-Jun-92	0.0000
B(BPORT)	Col B, B Port	30-Jun-92	0.0000
B(APORT)	Col B, A Port	30-Jun-92	0.0000
C(CPORT)	Col C, C Port	30-Jun-92	0.0000
C(BPORT)	Col C, B Port	30-Jun-92	0.0000
C(APORT)	Col C, A Port	30-Jun-92	0.0000
D(CPORT)	Col D, C Port	30-Jun-92	0.0000
D(BPORT)	Col D, B Port	30-Jun-92	0.0000
D(APORT)	Col D, A Port	30-Jun-92	0.0000
E-EFF	Col E Effluent	30-Jun-92	0.3179
E(BPORT)	Col E, B Port	30-Jun-92	0.0000
E(APORT)	Col E, A Port	30-Jun-92	0.6647
EINF	Col E Influent	30-Jun-92	14.8990
EINF	Col E Influent	30-Jun-92	15.0150
DINF	Col D Influent	30-Jun-92	14.2139
DINF	Col D Influent	30-Jun-92	14.0580
CINF	Col C Influent	30-Jun-92	13.5630
CINF	Col C Influent	30-Jun-92	13.7020
BINF	Col B Influent	30-Jun-92	5.7882
BINF	Col B Influent	30-Jun-92	5.6972
BINF	Col B Influent	30-Jun-92	0.0000
AINF	Col A Influent	30-Jun-92	5.1476
AINF	Col A Influent	30-Jun-92	5.3489
1PPM	Standard	30-Jun-92	1.1522
1PPM	Standard	30-Jun-92	1.1536
1PPM	Standard	30-Jun-92	1.1722
BLANK	Blank	30-Jun-92	0.0000
BINF	Col B Influent	1-Jul-92	11.3540
BINF	Col B Influent	1-Jul-92	0.0000
BINF	Col B Influent	1-Jul-92	13.3720
AINF	Col A Influent	1-Jul-92	12.5730
1PPM	Standard	1-Jul-92	1.1913
1PPM	Standard	1-Jul-92	1.1959
1PPM	Standard	1-Jul-92	0.0000
BLANK	Blank	1-Jul-92	0.0000
B(CPORT)	Col B, C Port	2-Jul-92	0.0000
B(BPORT)	Col B, B Port	2-Jul-92	0.3423
B(APORT)	Col B, A Port	2-Jul-92	0.8387
BINF	Col B Influent	2-Jul-92	10.4390
A(CPORT)	Col A, C Port	2-Jul-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
A(BPORT)	Col A, B Port	2-Jul-92	0.4433
A(APORT)	Col A, A Port	2-Jul-92	1.0765
AINF	Col A Influent	2-Jul-92	12.0390
AINF	Col A Influent	2-Jul-92	17.3890
AINF	Col A Influent	2-Jul-92	23.5010
AINF	Col A Influent	2-Jul-92	29.6770
AINF	Col A Influent	2-Jul-92	0.0000
AINF	Col A Influent	2-Jul-92	0.0000
1PPM	Standard	2-Jul-92	1.1446
1PPM	Standard	2-Jul-92	0.0000
1PPM	Standard	2-Jul-92	1.1201
BLANK	Blank	2-Jul-92	0.0000
BLANK	Blank	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	1.0539
1PPM	Standard	8-Jul-92	1.0656
1PPM	Standard	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	1.0602
1PPM	Standard	8-Jul-92	1.0440
AINF	Col A Influent	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	1.0587
1PPM	Standard	8-Jul-92	1.0466
AINF	Col A Influent	8-Jul-92	10.4090
A(APORT)	Col A, A Port	8-Jul-92	0.0000
A(BPORT)	Col A, B Port	8-Jul-92	0.7654
A(CPORT)	Col A, C Port	8-Jul-92	0.5608
A(APORT)	Col A, A Port	8-Jul-92	0.4804
BINF	Col B Influent	8-Jul-92	8.6946
B(APORT)	Col B, A Port	8-Jul-92	0.5461
B(BPORT)	Col B, B Port	8-Jul-92	0.0000
B(CPORT)	Col B, C Port	8-Jul-92	0.0000
B(CPORT)	Col B, C Port	8-Jul-92	0.0000
A(APORT)	Col A, A Port	8-Jul-92	0.3854
A(BPORT)	Col A, B Port	8-Jul-92	0.0000
A(BPORT)	Col A, B Port	8-Jul-92	0.4699
A(CPORT)	Col A, C Port	8-Jul-92	0.3633
CINF	Col C Influent	8-Jul-92	15.4340
C(APORT)	Col A, A Port	8-Jul-92	1.0119
C(BPORT)	Col C, B Port	8-Jul-92	0.2917
C(CPORT)	Col C, C Port	8-Jul-92	0.0000
DINF	Col D Influent	8-Jul-92	0.0000
1PPM	Standard	8-Jul-92	1.2444
DINF	Col D Influent	8-Jul-92	15.4720
D(APORT)	Col D, A Port	8-Jul-92	1.0133
BLANK	Blank	10-Jul-92	0.0000
E(CPORT)	Col E, C Port	14-Jul-92	0.0000
E(BPORT)	Col E, B Port	14-Jul-92	0.0000
E(APORT)	Col E, A Port	14-Jul-92	0.0000
EINF	Col E Influent	14-Jul-92	15.9810
D(CPORT)	Col D, C Port	14-Jul-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
D(BPORT)	Col D, B Port	14-Jul-92	0.0000
D(APORT)	Col D, A Port	14-Jul-92	0.2362
DINF	Col D Influent	14-Jul-92	15.3890
A(CPORT)	Col A, C Port	14-Jul-92	0.0000
A(BPORT)	Col A, B Port	14-Jul-92	0.0000
A(APORT)	Col A, A Port	14-Jul-92	0.0000
AINF	Col A Influent	14-Jul-92	3.3762
C(CPORT)	Col C, C Port	14-Jul-92	0.0000
C(BPORT)	Col C, B Port	14-Jul-92	0.0000
C(APORT)	Col C, A Port	14-Jul-92	0.2149
CINF	Col C Influent	14-Jul-92	15.0540
B(CPORT)	Col B, C Port	14-Jul-92	0.0000
B(BPORT)	Col B, B Port	14-Jul-92	0.0000
B(APORT)	Col B, A Port	14-Jul-92	0.0000
BINF	Col B Influent	14-Jul-92	3.1551
1PPM	Standard	14-Jul-92	1.1605
BINF	Col B Influent	14-Jul-92	3.1732
BINF	Col B Influent	14-Jul-92	3.2495
BINF	Col B Influent	14-Jul-92	3.0927
BINF	Col B Influent	14-Jul-92	7.2615
BINF	Col B Influent	14-Jul-92	6.2898
BINF	Col B Influent	14-Jul-92	0.0000
1PPM	Standard	14-Jul-92	1.1828
1PPM	Standard	14-Jul-92	1.1565
1PPM	Standard	14-Jul-92	0.0000
1PPM	Standard	14-Jul-92	0.0000
1PPM	Standard	14-Jul-92	0.0000
1PPM	Standard	14-Jul-92	0.0000
BLANK	Blank	14-Jul-92	0.0000
EINF	Col E Influent	21-Jul-92	17.5650
E(APORT)	Col E, A Port	21-Jul-92	0.3061
E(BPORT)	Col E, B Port	21-Jul-92	0.0000
E-EFF	Col E Effluent	21-Jul-92	0.0000
DINF	Col D Influent	21-Jul-92	17.3990
D(APORT)	Col D, A Port	21-Jul-92	0.3801
D(BPORT)	Col D, B Port	21-Jul-92	0.0000
DEFF	Col D Effluent	21-Jul-92	0.0000
1PPM	Standard	21-Jul-92	1.1420
CINF	Col C Influent	21-Jul-92	17.8290
C(APORT)	Col C, A Port	21-Jul-92	0.0000
C(BPORT)	Col C, B Port	21-Jul-92	0.0000
CEFF	Col C Effluent	21-Jul-92	0.0000
BINF	Col B Influent	21-Jul-92	3.6831
B(APORT)	Col B, A Port	21-Jul-92	0.0000
B(BPORT)	Col B, B Port	21-Jul-92	0.0000
B-EFF	Col B Effluent	21-Jul-92	0.0000
AINF	Col A Influent	21-Jul-92	3.8084
A(APORT)	Col A, A Port	21-Jul-92	0.0000
A(BPORT)	Col A, B Port	21-Jul-92	0.0000
A-EFF	Col A Effluent	21-Jul-92	0.0000
1PPM	Standard	21-Jul-92	1.0814
BLANK	Blank	29-Jul-92	0.0000
1PPM	Standard	29-Jul-92	0.0000
1PPM	Standard	29-Jul-92	0.0000
1PPM	Standard	29-Jul-92	1.0643

Code	Description	Date	Analysis (Toluene, ppm)
A/INF	Col A influent	29-Jul-92	7.9088
A/APORT	Col A, A Port	29-Jul-92	0.0000
A/BPORT	Col A, B Port	29-Jul-92	0.0000
A/CPORT	Col A, C Port	29-Jul-92	0.0000
B/INF	Col B influent	29-Jul-92	7.9286
B/APORT	Col B, A Port	29-Jul-92	0.0000
B/BPORT	Col B, B Port	29-Jul-92	0.0000
B/CPORT	Col B, C Port	29-Jul-92	0.0000
C/INF	Col C influent	29-Jul-92	18.4070
C/APORT	Col C, A Port	29-Jul-92	0.0000
C/BPORT	Col C, B Port	29-Jul-92	0.0000
C/CPORT	Col C, C Port	29-Jul-92	0.0000
D/INF	Col D influent	29-Jul-92	16.0290
D/APORT	Col D, A Port	29-Jul-92	0.0000
D/BPORT	Col D, B Port	29-Jul-92	0.0000
D/CPORT	Col D, C Port	29-Jul-92	0.0000
E/INF	Col E influent	29-Jul-92	16.0900
E/APORT	Col E, A Port	29-Jul-92	0.0000
E/BPORT	Col E, B Port	29-Jul-92	0.0000
E/CPORT	Col E, C Port	29-Jul-92	0.0000
1PPM	Standard	4-Aug-92	1.1010
1PPM	Standard	4-Aug-92	1.1650
1PPM	Standard	4-Aug-92	1.1540
1PPM	Standard	4-Aug-92	1.1700
E/INF	Col E influent	4-Aug-92	15.9120
E/APORT	Col E, A Port	4-Aug-92	0.2270
E/BPORT	Col E, B Port	4-Aug-92	0.0000
E/EEF	Col E Effluent	4-Aug-92	0.0000
D/INF	Col D Influent	4-Aug-92	15.8390
D/APORT	Col D, A Port	4-Aug-92	0.1810
D/BPORT	Col D, B Port	4-Aug-92	0.0000
D/EEF	Col D Effluent	4-Aug-92	0.0000
1PPM	Standard	5-Aug-92	0.7650
1PPM	Standard	5-Aug-92	0.5310
1PPM	Standard	5-Aug-92	0.9900
1PPM	Standard	5-Aug-92	0.5800
1PPM	Standard	5-Aug-92	0.4720
1PPM	Standard	5-Aug-92	1.0780
1PPM	Standard	5-Aug-92	1.0880
1PPM	Standard	5-Aug-92	1.0690
E/INF	Col E Influent	5-Aug-92	17.1310
E/APORT	Col E, A Port	5-Aug-92	0.4650
E/BPORT	Col E, B Port	5-Aug-92	0.1020
E/EEF	Col E Effluent	5-Aug-92	0.0000
D/INF	Col D Influent	5-Aug-92	16.1690
D/APORT	Col D, A Port	5-Aug-92	0.4430
D/BPORT	Col D, B Port	5-Aug-92	0.0000
D/EEF	Col D Effluent	5-Aug-92	0.0000
C/INF	Col C Influent	5-Aug-92	17.7510
C/APORT	Col C, A Port	5-Aug-92	0.6050
C/BPORT	Col C, B Port	5-Aug-92	0.0000
C/EEF	Col C Effluent	5-Aug-92	0.0000
B/INF	Col B Influent	5-Aug-92	8.3150
B/APORT	Col B, A Port	5-Aug-92	0.9800
B/BPORT	Col B, B Port	5-Aug-92	0.0690

Code	Description	Date	Analysis (Toluene, ppm)
B/APORT	Col B, A Port	5-Aug-92	0.0830
B/BPORT	Col B, B Port	5-Aug-92	0.0000
B/EFF	Col B Effluent	5-Aug-92	0.0000
A/OMF	Col A Influent	5-Aug-92	7.3990
A/APORT	Col A, A Port	5-Aug-92	0.2180
A/BPORT	Col A, B Port	5-Aug-92	0.0000
A/EFF	Col A Effluent	5-Aug-92	0.0000
1PPM	Standard	7-Aug-92	0.9930
1PPM	Standard	7-Aug-92	1.0790
1PPM	Standard	7-Aug-92	0.9850
A/INF	Col A Influent	7-Aug-92	7.9490
A/APORT	Col A, A Port	7-Aug-92	0.7050
A/BPORT	Col A, B Port	7-Aug-92	0.8640
A/EFF	Col A Effluent	7-Aug-92	0.3690
B/INF	Col B Influent	7-Aug-92	7.7740
B/APORT	Col B, A Port	7-Aug-92	0.4450
B/BPORT	Col B, B Port	7-Aug-92	0.1510
B/EFF	Col B Effluent	7-Aug-92	0.0000
1PPM	Standard	10-Aug-92	1.1920
1PPM	Standard	10-Aug-92	1.1030
1PPM	Standard	10-Aug-92	1.0000
1PPM	Standard	10-Aug-92	1.1750
B/INF	Col B Influent	10-Aug-92	9.8480
B/APORT	Col B, A Port	10-Aug-92	0.0000
B/APORT	Col B, A Port	10-Aug-92	0.1150
B/BPORT	Col B, B Port	10-Aug-92	0.0000
B/EFF	Col B Effluent	10-Aug-92	0.0000
A/INF	Col A Influent	10-Aug-92	9.3380
A/APORT	Col A, A Port	10-Aug-92	0.6490
A/BPORT	Col A, B Port	10-Aug-92	0.2100
A/EFF	Col A Effluent	10-Aug-92	0.0000
1PPM	Standard	11-Aug-92	0.9620
1PPM	Standard	11-Aug-92	1.0270
E/INF	Col E Influent	11-Aug-92	18.9120
E/APORT	Col E, A Port	11-Aug-92	0.2140
E/BPORT	Col E, B Port	11-Aug-92	0.0720
E/EEF	Col E Effluent	11-Aug-92	0.0000
D/INF	Col D Influent	11-Aug-92	18.5600
D/APORT	Col D, A Port	11-Aug-92	0.1860
D/BPORT	Col D, B Port	11-Aug-92	0.0000
D/EFF	Col D Effluent	11-Aug-92	0.0000
C/INF	Col C Influent	11-Aug-92	19.3620
C/APORT	Col C, A Port	11-Aug-92	0.1770
C/BPORT	Col C, B Port	11-Aug-92	0.0000
C/EFF	Col C Effluent	11-Aug-92	0.0000
1PPM	Standard	11-Aug-92	1.2550
1PPM	Standard	11-Aug-92	0.5420
1PPM	Standard	11-Aug-92	1.2070
1PPM	Standard	11-Aug-92	1.1880
1PPM	Standard	11-Aug-92	1.2440
B/INF	Col B Influent	11-Aug-92	10.5570
B/APORT	Col B, A Port	11-Aug-92	0.0000
B/BPORT	Col B, B Port	11-Aug-92	0.0000
B/EFF	Col B Effluent	11-Aug-92	0.0000
A/INF	Col A Influent	11-Aug-92	10.6150

Code	Description	Date	Analysis (Toluene, ppm)
A/APORT	Col A, A Port	11-Aug-92	0.1910
A/BPORT	Col A, B Port	11-Aug-92	0.0890
A/EFF	Col A Effluent	11-Aug-92	0.0000
1PPM	Standard	17-Aug-92	1.2500
1PPM	Standard	17-Aug-92	1.2480
1PPM	Standard	17-Aug-92	1.1840
E/INF	Col E Influent	17-Aug-92	12.5820
A/INF	Col A Influent	17-Aug-92	10.6040
A/APORT	Col A, A Port	17-Aug-92	0.3490
A/BPORT	Col A, B Port	17-Aug-92	0.0880
A/EFF	Col A Effluent	17-Aug-92	0.0000
1PPM	Standard	19-Aug-92	1.2140
1PPM	Standard	19-Aug-92	1.2260
1PPM	Standard	19-Aug-92	1.2750
1PPM	Standard	19-Aug-92	1.1760
1PPM	Standard	19-Aug-92	1.2110
E/INF	Col E Influent	19-Aug-92	12.8370
E/APORT	Col E, A Port	19-Aug-92	0.0000
E/BPORT	Col E, B Port	19-Aug-92	0.0000
E/EFF	Col E Effluent	19-Aug-92	0.0000
1PPM	Standard	20-Aug-92	1.2620
1PPM	Standard	20-Aug-92	1.1840
1PPM	Standard	21-Aug-92	1.1130
E/INF	Col E Influent	21-Aug-92	13.0650
E/APORT	Col E, A Port	21-Aug-92	0.1460
E/BPORT	Col E, B Port	21-Aug-92	0.0000
E/EFF	Col E Effluent	21-Aug-92	0.0000
D/INF	Col D Influent	21-Aug-92	12.4420
D/APORT	Col D, A Port	21-Aug-92	0.0000
D/BPORT	Col D, B Port	21-Aug-92	0.0000
D/EFF	Col. D Effluent	21-Aug-92	0.0000
C/INF	Col C Influent	21-Aug-92	14.8220
1PPM	Standard	24-Aug-92	1.2550
1PPM	Standard	24-Aug-92	1.0810
1PPM	Standard	24-Aug-92	1.2540
A/APORT	Col A, A Port	24-Aug-92	0.4060
1PPM	Standard	25-Aug-92	1.1960
1PPM	Standard	25-Aug-92	1.1790
1PPM	Standard	25-Aug-92	1.1980
E/INF	Col E Influent	25-Aug-92	12.4430
E/APORT	Col E, A Port	25-Aug-92	0.2810
E/BPORT	Col E, B Port	25-Aug-92	0.0000
E/EFF	Col E Effluent	25-Aug-92	0.0000
D/INF	Col D Influent	25-Aug-92	11.3140
D/APORT	Col D, A Port	25-Aug-92	0.1840
D/BPORT	Col D, B Port	25-Aug-92	0.0650
D/EFF	Col D Effluent	25-Aug-92	0.0000
C/INF	Col C Influent	25-Aug-92	12.3780
C/APORT	Col C, A Port	25-Aug-92	0.2210
C/BPORT	Col C, B Port	25-Aug-92	0.0000
C/EFF	Col C Effluent	25-Aug-92	0.0000
B/INF	Col B Influent	25-Aug-92	4.6930
B/APORT	Col B, A Port	25-Aug-92	1.3940
B/BPORT	Col B, B Port	25-Aug-92	0.0000
B/EFF	Col B Effluent	26-Aug-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
A/INF	Col A Influent	26-Aug-92	10.1210
A/APORT	Col A, A Port	26-Aug-92	0.0730
A/BPORT	Col A, B Port	26-Aug-92	0.0000
1PPM	Standard	27-Aug-92	1.2470
1PPM	Standard	27-Aug-92	1.2190
1PPM	Standard	27-Aug-92	1.1830
E/INF	Col E Influent	27-Aug-92	12.0830
E/APORT	Col E, A Port	27-Aug-92	0.0000
E/APORT	Col E, A Port	27-Aug-92	0.0000
E/BPORT	Col E, B Port	27-Aug-92	0.0000
E/EFF	Col E Effluent	27-Aug-92	0.0000
D/INF	Col D Influent	27-Aug-92	10.2600
D/APORT	Col D, A Port	27-Aug-92	0.2940
D/EFF	Col D Effluent	27-Aug-92	0.0000
C/INF	Col C Influent	27-Aug-92	6.8670
C/APORT	Col C, A Port	27-Aug-92	0.1170
C/BPORT	Col C, B Port	27-Aug-92	0.0840
C/EFF	Col C Effluent	27-Aug-92	0.0000
B/INF	Col B Influent	27-Aug-92	9.5670
B/APORT	Col B, A Port	27-Aug-92	0.3040
B/B PORT	Col B, B Port	27-Aug-92	0.0000
B/EFF	Col B Effluent	27-Aug-92	0.0000
A/INF	Col A Influent	27-Aug-92	9.7620
A/APORT	Col A, A Port	27-Aug-92	0.0000
A/BPORT	Col A, B Port	27-Aug-92	0.0530
1 PPM	Standard	9-Sep-92	0.82
1 PPM	Standard	9-Sep-92	1.0230
A/INF	Col A Influent	9-Sep-92	9.5130
B/INF	Col. B Influent	9-Sep-92	47.4200
C/INF	Col. C Influent	9-Sep-92	1.4220
D/INF	Col. D Influent	9-Sep-92	48.5800
E/INF	Col E Influent	9-Sep-92	47.5800
A/INF	Col A Influent	9-Sep-92	13.3200
1PPM	Standard	10-Sep-92	1.0830
1 PPM	Standard	10-Sep-92	1.0440
A/INF	Col A Influent	10-Sep-92	15.0100
A\ A PORT	Col A Port A	10-Sep-92	0.6190
A\B PORT	Col A, Port B	10-Sep-92	0.0680
A\EFF	Col A, Effluent	10-Sep-92	0.0000
B\INF	Col B, Influent	10-Sep-92	29.3600
B\A PORT	Col B, Port a	10-Sep-92	0.7890
B\B PORT	Col B, Port B	10-Sep-92	0.0690
B\EFF	Col B, Effluent	10-Sep-92	0.0000
1 PPM	Standard	22-Sep-92	0.7970
1 PPM	Standard	22-Sep-92	0.8000
1 PPM	Standard	22-Sep-92	0.8000
A/INF	Col. A, Influent	22-Sep-92	9.8350
A\PORT A	Col. A, Port A	22-Sep-92	0.0000
A\PORT B	Col. A, Port B	22-Sep-92	0.0000
A\Eff	Col. A, Effluent	22-Sep-92	0.0000
B\INF	Col. B, Influent	22-Sep-92	12.2650
B\PORT A	Col B, Port A	22-Sep-92	0.2880
B\PORT B	Col. B, Port B	22-Sep-92	0.0000
B\EFF	Col. B, Effluent	22-Sep-92	0.0000
C/INF	Col. C, Influent	22-Sep-92	14.6490

Code	Description	Date	Analysis (Toluene, ppm)
C\PORT A	Col. C, Port A	22-Sep-92	0.1650
C\PORT B	Col. C, Port B	22-Sep-92	0.0910
1 PPM	Standard	23-Sep-92	0.7680
1 PPM	Standard	23-Sep-92	0.6310
1PPM	Standard	23-Sep-92	0.8350
C\Eff	Col. C, effluent	23-Sep-92	0.0000
D\INF	Col. D, Influent	23-Sep-92	13.7360
D\PORT A	Col. D, Port A	23-Sep-92	0.2700
D\PORT B	Col. D, Port B	23-Sep-92	0.0000
D\EFF	Col. D, Effluent	23-Sep-92	0.0000
E\INF	Col. E, Influent	23-Sep-92	14.9500
E\PORT A	Col. E, Port A	23-Sep-92	0.2160
E\PORT B	Col. E, Port B	23-Sep-92	0.0000
E\EFF	Col. E, Effluent	23-Sep-92	0.0000
1 PPM	Standard	30-Sep-92	1.0000
1 PPM	Standard	30-Sep-92	0.9370
A\INF	Col. A, Influent	30-Sep-92	4.9400
A\PORT A	Col. A, Port A	30-Sep-92	0.1190
A\PORT B	Col. A, Port B	30-Sep-92	0.1090
A\EFF	Col. A, Effluent	30-Sep-92	0.0000
B\INF	Col. B, Influent	30-Sep-92	10.2700
B\PORT A	Col. B, Port A	30-Sep-92	0.1640
B\PORT B	Col. B, Port B	30-Sep-92	0.0000
B\EFF	Col. B, Effluent	30-Sep-92	0.0000
C\INF	Col. C, Influent	30-Sep-92	16.5500
C\PORT A	Col. C, Port A	30-Sep-92	0.2360
C\PORT B	Col. C, Port B	30-Sep-92	0.0000
C\EFF	Col. C, effluent	30-Sep-92	0.0000
D\INF	Col. D, Influent	30-Sep-92	16.0500
D\PORT A	Col. D, Port A	30-Sep-92	0.4990
D\PORT B	Col. D, Port B	30-Sep-92	0.0000
1 PPM	Standard	1-Oct-92	0.9360
1 PPM	Standard	1-Oct-92	0.8540
D\EFF	Col. D, Effluent	1-Oct-92	0.0000
E\INF	Col. E, Influent	1-Oct-92	16.5500
E\PORT A	Col. E, Port A	1-Oct-92	0.0000
E\PORT B	Col. E, Port b	1-Oct-92	0.0000
E\EFF	Col. E, Effluent	1-Oct-92	0.0000
1 PPM	Standard	9-Oct-92	1.0100
1 PPM	Standard	9-Oct-92	0.9560
1 PPM	Standard	9-Oct-92	1.0280
A\INF	Col. A, Influent	9-Oct-92	14.4700
A\PORT A	Col. A, Port A	9-Oct-92	0.0000
A\PORT B	Col. A, Port B	9-Oct-92	0.0000
A\EFF	Col. A, Effluent	9-Oct-92	0.1160
B\INF	Col. B, Influent	9-Oct-92	10.0800
B\PORT A	Col. B, Port a	9-Oct-92	2.9200
B\PORT b	Col. B, Port B	9-Oct-92	0.0000
B\EFF	Col. B, Effluent	9-Oct-92	0.0000
C\INF	Col. C, Influent	9-Oct-92	16.8300
C\PORT A	Col. C, Port A	9-Oct-92	0.0000
C\PORT B	Col. C, Port B	9-Oct-92	0.0000
C\EFF	Col. C, Effluent	9-Oct-92	0.0000
D\INF	Col. D, Influent	9-Oct-92	17.0300
D\PORT A	Col. D, Port A	9-Oct-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
D\PORT B	Col. D, Port B	9-Oct-92	0.0000
D\EFF	Col. D, Effluent	9-Oct-92	0.0000
E\INF	Col. E, Influent	9-Oct-92	17.7700
E\PORT A	Col. E, Port A	9-Oct-92	0.0000
E\PORT B	Col. e, Port B	9-Oct-92	0.0000
E\EFF	Col. E, Effluent	9-Oct-92	0.0000
1 PPM	Standard	14-Oct-92	1.0200
1 PPM	Standard	14-Oct-92	1.0920
1 PPM	Standard	14-Oct-92	1.0500
A\INF	Col.A, influent	14-Oct-92	16.3000
A\PORT A	Col. A, Port A	14-Oct-92	2.6300
A\PORT B	Col. a, Port B	14-Oct-92	0.0000
A\EFF	Col.A, Effluent	14-Oct-92	0.0000
B\INF	Col. B, Influent	14-Oct-92	9.9100
B\PORT A	Col. B, Port A	14-Oct-92	0.2260
B\PORT B	Col. B, Port B	14-Oct-92	0.0000
B\EFF	Col. B, Effluent	14-Oct-92	0.0000
C\INF	Col. C, Influent	14-Oct-92	15.9500
C\PORT A	Col. C, Port a	14-Oct-92	0.0000
C\PORT B	Col. C, PortB	14-Oct-92	0.0000
C\EFF	Col. C, Effluent	14-Oct-92	0.0000
D\INF	Col. D, Influent	14-Oct-92	12.2200
D\PORT A	Col. D, Port A	14-Oct-92	0.1600
D\PORT B	Col. D, Port B	14-Oct-92	0.0000
D\EFF	Col. D, Effluent	14-Oct-92	0.0000
E\INF	Col. E, Influent	14-Oct-92	16.4500
E\PORT A	Col. E, Port A	14-Oct-92	0.0000
E\PORT B	Col. E, Port B	14-Oct-92	0.1340
E\EFF	Col. E, Effluent	14-Oct-92	0.0000
1 PPM	1 PPM Stsndard	15-Oct-92	1.0300
1 PPM	1 PPM Standard	15-Oct-92	1.1200
1 PPM	1 PPM Standaard	15-Oct-92	1.1400
A\INF	Col. A, Influent	15-Oct-92	17.6200
A\PORT A	Col. A, Port A	15-Oct-92	2.5200
A\PORT B	Col A, Port B	15-Oct-92	0.0000
A\EFF	Col A, Effluent	15-Oct-92	0.0000
B\INF	Col B, Influent	15-Oct-92	10.2400
B\PORT A	Col B, Port A	15-Oct-92	3.3400
B\PORT B	Col B, Port B	15-Oct-92	0.0000
B\EFF	Col B, Effluent	15-Oct-92	0.0000
C\INF	Col C, Influent	15-Oct-92	14.9200
C\PORT A	Col C, Port a	15-Oct-92	0.0000
C\PORT B	Col C, Port B	15-Oct-92	0.0000
C\EFF	Col C, Effluent	15-Oct-92	0.0000
D\INF	Col D, Influent	15-Oct-92	15.9500
D\PORT A	Col D, Port A	15-Oct-92	0.0000
D\PORT B	Col D, Port B	15-Oct-92	0.0000
D\EFF	Col D, Effluent	15-Oct-92	0.0000
E\INF	Col E, Influent	15-Oct-92	14.1500
E\PORT A	Col E, PortA	15-Oct-92	0.0000
E\PORT B	Col E, Port B	15-Oct-92	0.0000
E\EFF	Col E, Effluent	15-Oct-92	0.0000
A\INF	Col. A, Influent	19-Oct-92	13.9000
A\PORT A	Col A, Port A	19-Oct-92	0.7850
A\PORT B	Col A, Port B	19-Oct-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
A\EFF	Col A, Effluent	19-Oct-92	0.0000
B\INF	Col B, Influent	19-Oct-92	10.1900
B\PORT A	Col B, Port A	19-Oct-92	2.6760
B\PORT B	Col B, Port B	19-Oct-92	0.0000
B\Eff	ColB, Effluent	19-Oct-92	0.0000
C\INF	Col C Influent	19-Oct-92	3.0000
C\PORT A	Col C, Port A	19-Oct-92	0.7160
C\PORT B	Col C, Port B	19-Oct-92	0.0000
C\EFF	Col C, Effluent	19-Oct-92	0.0000
D\INF	Col D, Influent	19-Oct-92	13.5700
D\PORT A	Col D, Port A	19-Oct-92	0.3660
D\PORT B	Col D, Port B	19-Oct-92	0.0000
1 PPM	1 PPM Standard sep. leak	19-Oct-92	0.5370
1 PPM	1 PPM Standard	19-Oct-92	0.9100
1 PPM	1 PPM Standard	19-Oct-92	0.9300
E\INF	ColE, Influent	19-Oct-92	16.4300
E\PORT A	Col E, Port A	19-Oct-92	0.2030
E\PORT B	Col E, PortB	19-Oct-92	0.0000
E\EFF	Col E, Effluent	19-Oct-92	0.0000
1 PPMStandardPPm		21-Oct-92	0.8000
1 PPM	1 PPM Standard	21-Oct-92	0.7200
1 PPM	1 PPM Standard	21-Oct-92	0.7300
1 PPM	1 PPM Standard	21-Oct-92	0.8300
A\INF	Col A, Influent	21-Oct-92	12.9300
A\PORT A	Col A, Port A	21-Oct-92	0.0000
A\PORT B	Col A, Port B	21-Oct-92	0.0000
A\EFF	Col A, Effluent	21-Oct-92	0.0000
B\INF	Col B, Influent	21-Oct-92	10.0000
B\PORT A	Col B, Port A	21-Oct-92	0.5980
B\PORT B	Col B, Port B	21-Oct-92	0.0000
B\Eff	Col B, Effluent	21-Oct-92	0.0000
C\INF	Col C, Influent	21-Oct-92	14.6600
C\PORT A	Col C, Port A	21-Oct-92	0.9650
C\PORT B	Col C, Port B	21-Oct-92	0.1180
C\EFF	Col C, Effluent	21-Oct-92	0.0000
D\INF	Col D, Influent	21-Oct-92	14.2100
D\PORT A	Col D, Port A	21-Oct-92	0.4940
D\PORT B	Col D, Port B	21-Oct-92	0.0860
D\EFF	Col D, Effluent	21-Oct-92	0.0000
1 PPM	Standard	23-Oct-92	0.9000
1 PPM	Standard	23-Oct-92	0.8800
1 PPM	Standard	23-Oct-92	0.8400
A\INF	Col A, Influent	23-Oct-92	9.3600
A\PORT A	Col A, Port A	23-Oct-92	4.3500
A\PORT B	Col A, Port B	23-Oct-92	0.0000
A\Eff	Col A, Effluent	23-Oct-92	0.1440
B\INF	Col B, Influent	23-Oct-92	10.0700
B\PORT A	Col B, Port A	23-Oct-92	3.8800
B\PORT B	Col B, Port b	23-Oct-92	0.0000
B\EFF	Col B, Effluent	23-Oct-92	0.0000
C\INF	Col C, Influent	23-Oct-92	16.4600
C\PORT A	Col C, Port A	23-Oct-92	0.0000
C\PORT B	Col C, Port B	23-Oct-92	0.0000
C\EFF	Col C, Effluent	23-Oct-92	0.0000
D\INF	Col D, Influent	23-Oct-92	16.0900

Code	Description	Date	Analysis (Toluene, ppm)
D\PORT A	Col D, Port A	23-Oct-92	0.0000
D\PORT B	Col d, Port B	23-Oct-92	0.0000
D\EFF	Col d, Effluent	23-Oct-92	0.0000
E\INF	Col E, Influent	23-Oct-92	5.1900
E\PORT A	Col E, Port A	23-Oct-92	0.0000
E\PORT B	Col E, Port B	23-Oct-92	0.0000
E\EFF	Col E, Effluent	23-Oct-92	0.0000
1 PPM	Standard	27-Oct-92	0.7900
1 PPM	Standard	27-Oct-92	0.8800
1 PPM	Standard	27-Oct-92	0.8600
A\INF	Col A, Influent	27-Oct-92	12.7300
A\PORT A	Col A, Port A	27-Oct-92	0.8900
A\PORT B	Col A, Port B	27-Oct-92	0.0000
A\EFF	Col a, Effluent	27-Oct-92	0.1100
B\INF	Col B, Influent	27-Oct-92	9.8500
B\PORT A	Col B, Port A	27-Oct-92	2.6500
B\PORT B	Col B, Port B	27-Oct-92	0.1430
B\EFF	Col B, Effluent	27-Oct-92	0.0000
C\INF	Col C, Influent	27-Oct-92	14.5200
C\PORT A	Col C, Port A	27-Oct-92	0.1780
C\PORT B	Col C, Port B	27-Oct-92	0.0790
C\EFF	Col C, Effluent	27-Oct-92	0.0000
D\INF	Col D, Influent	27-Oct-92	14.3100
D\PORT A	Col D, Port A	27-Oct-92	0.4900
D\PORT B	Col D, Port B	27-Oct-92	0.0000
D\EFF	Col D, Effluent	27-Oct-92	0.0000
1 PPM	Standard	29-Oct-92	0.9500
1 PPM	Standard	29-Oct-92	1.0190
1 PPM	Standard	29-Oct-92	0.9400
A\INF	Col A, Influent	29-Oct-92	13.3700
A\PORT A	Col A, Port A	29-Oct-92	0.2700
A\PORT B	Col A, Port B	29-Oct-92	0.3500
A\EFF	Col A, Effluent	29-Oct-92	0.0000
B\INF	Col B, Influent	29-Oct-92	9.6100
B\PORT A	Col B, Port A	29-Oct-92	0.3700
B\PORT B	Col B, Port B	29-Oct-92	0.2200
B\EFF	Col B, Effluent	29-Oct-92	0.0000
C\INF	Col C, Influent	29-Oct-92	10.6200
C\PORT A	Col C, Port A	29-Oct-92	0.3800
C\PORT B	Col C, Port B	29-Oct-92	0.0000
C\EFF	Col C, Effluent	29-Oct-92	0.0000
D\INF	Col D, Influent	29-Oct-92	14.6800
D\PORT A	Col D, Port A	29-Oct-92	0.1200
D\PORT B	Col D, Port B	29-Oct-92	0.2600
D\EFF	Col D, Effluent	29-Oct-92	0.0000
E\INF	Col E, Influent	29-Oct-92	14.2200
E\PORT A	Col E, Port A	29-Oct-92	0.0870
E\PORT B	Col E, Port B	29-Oct-92	0.3400
E\EFF	Col E, Effluent	29-Oct-92	0.0000
1 PPM	Standard	2-Nov-92	0.8800
1 PPM	Standard	2-Nov-92	0.9200
1 PPM	Standard	2-Nov-92	1.0000
A\INF	Col. A, Influent	2-Nov-92	12.8100
A\PORT A	Col A, Port A	2-Nov-92	5.6100
A\PORT B	Col A, Port B	2-Nov-92	0.0910

Code	Description	Date	Analysis (Toluene, ppm)
A\EFF	Col A, Effluent	2-Nov-92	0.4130
B\INF	Col B, Influent	2-Nov-92	9.6300
B\PORT A	Col A, Port A	2-Nov-92	0.8500
B\PORT B	Col B, Port B	2-Nov-92	0.0900
B\EFF	Col B, Effluent	2-Nov-92	0.0000
C\Inf	Col C, Influent	2-Nov-92	15.7500
C\PORT A	Col C, Port A	2-Nov-92	0.7600
C\PORT B	Col C, Port B	2-Nov-92	0.0900
C\EFF	Col C, Effluent	2-Nov-92	0.0800
D\INF	Col D, Influent	2-Nov-92	15.0200
D\PORT A	Col D, Port A	2-Nov-92	0.2000
D\PORT B	Col D, Port B	2-Nov-92	0.0000
D\EFF	Col D, Effluent	2-Nov-92	0.0000
E\INF	Col E, Influent	2-Nov-92	15.8000
E\PORT A	Col E, Port A	2-Nov-92	0.3400
E\PORT B	Col E, Port B	2-Nov-92	0.0000
1 PPM	Standard	10-Nov-92	0.8600
1 PPM	Standard	10-Nov-92	0.7700
1 PPM	Standard	10-Nov-92	0.7800
1 PPM	Standard	10-Nov-92	1.1300
A\INF	Col A, Influent	10-Nov-92	13.9800
A\PORT A	Col A, Port A	10-Nov-92	6.4800
A\PORT B	Col A, Port B	10-Nov-92	0.0000
A\EFF	Col A, Effluent	10-Nov-92	0.0810
B\INF	Col B, Influent	10-Nov-92	8.4000
B\PORT A	Col B, Port A	10-Nov-92	1.8700
B\PORT B	Col B, Port B	10-Nov-92	0.0000
B\EFF	Col B, Effluent	10-Nov-92	0.0000
C\INF	Col C, Influent	10-Nov-92	16.6600
C\PORT A	Col C, Port A	10-Nov-92	0.0000
C\PORT B	Col C, Port B	10-Nov-92	0.0000
C\EFF	Col C, Effluent	10-Nov-92	0.0000
D\INF	Col D, Influent	10-Nov-92	16.3700
1 PPM	Standard	10-Nov-92	0.9700
1 PPM	Standard	10-Nov-92	0.9700
1 PPM	Standard	10-Nov-92	1.0200
D\PORT A	Col D, Port A	10-Nov-92	0.0000
D\PORT B	Col D, Port B	10-Nov-92	0.0000
D\EFF	Col D, Effluent	10-Nov-92	0.0000
E\INF	Col E, Influent	10-Nov-92	15.3800
E\PORT A	Col E, Port A	10-Nov-92	0.2190
E\PORT B	Col E, Port B	10-Nov-92	0.0000
E\EFF	Col E, Effluent	10-Nov-92	0.0000
1 PPM	standard	12-Nov-92	0.9200
1 PPM	standard	12-Nov-92	0.9200
1 PPM	standard	12-Nov-92	0.9200
A\INF	Col A, Influent	12-Nov-92	13.7100
A\PORT A	Col A, Port A	12-Nov-92	5.5000
A\PORT B	Col A, Port B	12-Nov-92	0.0000
A\EFF	Col A, Effluent	12-Nov-92	0.0000
B\INF	Col b, Influent	12-Nov-92	10.3800
B\PORT A	Col B, Port A	12-Nov-92	3.2500
B\PORT B	Col B, Port B	12-Nov-92	0.0000
B\EFF	Col B, Effluent	12-Nov-92	0.0000
C\INF	Col C, Influent	12-Nov-92	15.8000

Code	Description	Date	Analysis (Toluene, ppm)
C\PORT A	Col C, Port A	12-Nov-92	0.2070
C\PORT B	Col C, Port B	12-Nov-92	0.0000
C\EFF	Col C, Effluent	12-Nov-92	0.0000
D\INF	Col D, Influent	12-Nov-92	16.3700
D\PORT A	Col D, Port A	12-Nov-92	0.0000
D\PORT B	Col D, Port B	12-Nov-92	0.0000
D\EFF	Col D, Effluent	12-Nov-92	0.0000
E\INF	Col E, Influent	12-Nov-92	16.0300
E\PORT A	Col E, Port A	12-Nov-92	0.0000
E\PORT B	Col E, Port B	12-Nov-92	0.0000
E\EFF	Col E, Effluent	12-Nov-92	0.0000
A\INF	Col A, Influent	16-Nov-92	13.6600
A\PORT A	Col A, Port A	16-Nov-92	5.6100
A\PORT B	Col A, Port B	16-Nov-92	0.2100
A\EFF	Col A, Effluent	16-Nov-92	0.1430
B\INF	Col B, Influent	16-Nov-92	10.2600
B\PORT A	Col B, Port A	16-Nov-92	1.7700
B\PORT B	Col B, Port B	16-Nov-92	0.0000
B\EFF	Col B, Effluent	16-Nov-92	0.0000
C\INF	Col C, Influent	16-Nov-92	11.1200
C\PORT A	Col C, Port A	16-Nov-92	0.1400
C\PORT B	Col c, Port B	16-Nov-92	0.4200
A\INF	Col A, Influent	18-Nov-92	11.5200
A\PORT A	Col A, Port A	18-Nov-92	4.3800
A\PORT B	Col A, Port B	18-Nov-92	0.0000
A\EFF	Col A, Effluent	18-Nov-92	0.0000
B\INF	Col B, Influent	18-Nov-92	8.7300
B\PORT A	Col B, Port A	18-Nov-92	3.1800
B\PORT B	Col B, Port B	18-Nov-92	0.0000
B\EFF	Col B, Effluent	18-Nov-92	0.0000
C\INF	Col C, Influent	18-Nov-92	9.8400
C\PORT A	Col C, Port A	18-Nov-92	0.0900
C\PORT B	Col c, Port B	18-Nov-92	0.1440
C\EFF	Col C, Effluent	18-Nov-92	0.0000
D\INF	ColD, Influent	19-Nov-92	13.2000
D\PORT A	Col D, Port A	19-Nov-92	0.0880
D\PORT B	Col D, Port B	19-Nov-92	0.0000
D\EFF	Col D, Effluent	19-Nov-92	0.0000
E\INF	ColE, Influent	19-Nov-92	13.7200
E\PORT A	Col E, Port A	19-Nov-92	0.1340
E\PORT B	Col E, Port B	19-Nov-92	0.0900
E\EFF	Col E, Effluent	19-Nov-92	0.0000
A\INF	Col A, Influent	30-Nov-92	11.6600
A\PORT A	Col A, Port A	30-Nov-92	4.1200
A\PORT B	ColA, Port B	30-Nov-92	0.0990
A\EFF	Col A, Effluent	30-Nov-92	0.0000
A\INF	Col A, Influent	1-Dec-92	12.0400
A\PORT A	Co POrt A	1-Dec-92	3.8000
A\PORT B	Col A, Port B	1-Dec-92	0.0000
A\EFF	Col A, Effluent	1-Dec-92	0.0000
B\INF	Col B, Influent	1-Dec-92	8.2000
B\PORT A	Col B, Port A	1-Dec-92	4.8700
B\PORT B	Col B, Port B	1-Dec-92	1.3450
B\EFF	Col B, Effluent	1-Dec-92	0.0000
C\INF	Col C, Influent	1-Dec-92	12.7500

Code	Description	Date	Analysis (Toluene, ppm)
C\PORT A	Col C, Port A	1-Dec-92	0.2000
C\PORT B	Col C, Port B	1-Dec-92	0.0000
C\EFF	Col C, Effluent	1-Dec-92	0.0000
D\INF	Col D, Influent	1-Dec-92	14.2200
D\PORT A	Col D, Port A	1-Dec-92	0.5380
D\PORT B	Col D, Port B	1-Dec-92	0.5020
D\EFF	Col D, Effluent	1-Dec-92	0.0000
E\INF	Col E, Influent	1-Dec-92	14.8900
E\PORT A	Col E, Port A	1-Dec-92	0.2850
E\PORT B	Col E, Port B	1-Dec-92	0.0000
E\EFF	Col E, Effluent	1-Dec-92	0.0000
1 ppm	standard	7-Dec-92	1.0180
1 ppm	standard	7-Dec-92	0.9480
1 ppm	standard	7-Dec-92	0.9390
A\INF	Col A, Influent	7-Dec-92	14.7100
A\PORT A	Col A, Port A	7-Dec-92	1.0550
A\PORT B	Col A, Port B	7-Dec-92	0.3140
B\INF	Col B, Influent	7-Dec-92	17.8000
B\PORT A	Col B, Port A	7-Dec-92	0.7600
B\PORT B	Col B, Port B	7-Dec-92	0.3470
B\EFF	Col B, Effluent	8-Dec-92	0.3730
C\INF	Col C, Influent	8-Dec-92	15.0800
C\PORT A	Col C, Port A	8-Dec-92	0.6190
C\PORT B	Col C, Port B	8-Dec-92	0.2070
C\EFF	Col C, Effluent	8-Dec-92	0.2440
D\INF	Col D, Influent	8-Dec-92	16.0300
D\PORT A	Col D, Port A	8-Dec-92	0.3620
D\PORT B	Col D, Port B	8-Dec-92	0.0000
D\EFF	Col D, Effluent	8-Dec-92	0.0000
E\INF	Col E, Influent	8-Dec-92	18.5770
E\PORT A	Col E, Port A	8-Dec-92	0.3980
E\PORT B	Col E, Port B	8-Dec-92	0.1360
E\EFF	Col E, Effluent	8-Dec-92	0.0000
A\INF	Col A, Influent	10-Dec-92	13.3700
B\INF	Col B, Influent	10-Dec-92	10.3200
C\INF	Col C, Influent	10-Dec-92	8.5050
D\INF	Col D, Influent	10-Dec-92	18.4500
E\INF	Col E, Influent	10-Dec-92	15.2500
1 ppm	standard	14-Dec-92	0.8600
1 ppm	standard	14-Dec-92	1.0370
1 ppm	standard	14-Dec-92	1.0130
A\INF	Col A, Influent	14-Dec-92	16.6960
A\PORT A	Col A, Port A	14-Dec-92	3.8700
A\PORT B	Col A, Port B	14-Dec-92	0.0000
A\EFF	Col A, Effluent	14-Dec-92	0.0000
B\INF	Col B, Influent	14-Dec-92	10.1800
B\PORT A	Col B, Port A	14-Dec-92	4.1600
B\PORT B	Col B, Port B	14-Dec-92	0.1340
B\EFF	Col B, Effluent	14-Dec-92	0.0000
C\INF	Col C, Influent	14-Dec-92	14.7500
C\PORT A	Col C, Port A	14-Dec-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
C\PORT B	Col C, Port B	14-Dec-92	0.0000
C\EFF	Col C, Effluent	14-Dec-92	0.0000
D\INF	Col D, Influent	14-Dec-92	14.4370
D\PORT A	Col D, Port A	14-Dec-92	0.0000
D\PORT B	Col D, Port B	14-Dec-92	0.0000
D\EFF	Col D, Effluent	14-Dec-92	0.0000
E\INF	Col E, Influent	14-Dec-92	16.4230
E\PORT A	Col E, Port A	14-Dec-92	0.1310
E\PORT B	Col E, Port B	14-Dec-92	0.1830
E\EFF	Col E, Effluent	14-Dec-92	0.0000
1 ppm	standard	17-Dec-92	0.7700
1 ppm	standard	17-Dec-92	1.0000
1 ppm	standard	17-Dec-92	1.0400
A\INF	Col A, Influent	17-Dec-92	10.0880
A\PORT A	Col A, Port A	17-Dec-92	1.4300
A\PORT B	Col A, Port B	17-Dec-92	0.1140
a\EFF	Col A, Effluent	17-Dec-92	0.0000
B\INF	Col B, Influent	17-Dec-92	8.1500
B\PORT A	Col B, Port A	17-Dec-92	3.7800
B\PORT B	Col B, Port B	17-Dec-92	0.1300
B\EFF	Col B, Effluent	17-Dec-92	0.0000
C\INF	Col C, Influent	17-Dec-92	15.4700
C\PORT A	Col C, Port A	17-Dec-92	0.2020
C\PORT B	Col C, Port B	17-Dec-92	0.2030
C\EFF	Col C, Effluent	17-Dec-92	0.0000
D\INF	Col D, Influent	17-Dec-92	14.2500
D\PORT A	Col D, Port A	17-Dec-92	0.0000
D\PORT B	Col D, Port B	17-Dec-92	0.1300
D\EFF	Col D, Effluent	17-Dec-92	0.0000
E\INF	Col E, Influent	17-Dec-92	15.8600
E\PORT A	Col E, Port A	17-Dec-92	0.3290
E\PORT B	Col E, Port B	17-Dec-92	0.5200
E\EFF	Col E, Effluent	17-Dec-92	0.0000
1 ppm	standard	18-Dec-92	0.9800
1 ppm	standard	18-Dec-92	0.8170
1 ppm	standard	18-Dec-92	0.9480
A\INF	Col A, Influent	18-Dec-92	17.6700
A\PORT A	Col A, Port A	18-Dec-92	0.3000
A\PORT B	Col A, Port B	18-Dec-92	0.6130
A\EFF	Col a, Effluent	18-Dec-92	0.0150
B\INF	Col B, Influent	18-Dec-92	15.9660
B\PORT A	Col B, Port A	18-Dec-92	0.2460
B\PORT B	Col B, Port A	18-Dec-92	0.1300
B\EFF	Col B, Effluent	18-Dec-92	0.0000
1 ppm	standard	21-Dec-92	1.0100
1 ppm	standard	21-Dec-92	0.6140
1 ppm	standard	21-Dec-92	1.1490
A\INF	Col A, Influent	21-Dec-92	11.6000
A\PORT A	Col A, Port A	21-Dec-92	3.8900
A\PORT B	Col A, Port B	21-Dec-92	0.1380
A\EFF	Col a, Effluent	21-Dec-92	0.0000
B\INF	Col B, Influent	21-Dec-92	8.3500
B\PORT A	Col B, Port A	21-Dec-92	4.0300
B\PORT B	Col B, Port A	21-Dec-92	0.0000
B\EFF	Col B, Effluent	21-Dec-92	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
C\INF	Col C, Influent	21-Dec-92	17.4800
C\PORT A	Col C, Port A	21-Dec-92	0.1910
C\PORT B	Col C, Port B	21-Dec-92	0.2540
C\EFF	Col C, Effluent	21-Dec-92	0.0000
D\INF	Col D, Influent	21-Dec-92	16.5600
D\PORT A	Col D, Port A	21-Dec-92	0.3540
D\PORT B	Col D, Port B	21-Dec-92	0.0000
D\EFF	Col D, Effluent	21-Dec-92	0.0000
E\INF	Col E, Influent	21-Dec-92	7.9600
E\PORT A	Col E, Port A	21-Dec-92	0.1640
E\PORT B	Col E, Port B	21-Dec-92	0.3380
E\EFF	Col E, Effluent	21-Dec-92	
A\INF	Col A, Influent	22-Dec-92	7.8460
A\PORT A	Col A, Port A	22-Dec-92	1.4300
A\PORT B	Col A, Port B	22-Dec-92	0.0000
A\EFF	Col a, Effluent	22-Dec-92	0.0000
B\INF	Col B, Influent	22-Dec-92	15.8200
B\PORT A	Col B, Port A	22-Dec-92	0.0000
B\PORT B	Col B, Port A	22-Dec-92	0.1870
B\EFF	Col B, Effluent	22-Dec-92	0.0000
C\INF	Col C, Influent]	22-Dec-92	15.0000
C\PORT A	Col C, Port A	22-Dec-92	0.0000
C\PORT B	Col C, Port B	22-Dec-92	0.5910
C\EFF	Col C, Effluent	22-Dec-92	0.0000
1 ppm	standard	28-Dec-92	1.0000
1 ppm	standard	28-Dec-92	0.7430
1 ppm	standard	28-Dec-92	0.8910
A\INF	Col A, Influent	28-Dec-92	
A\PORT A	Col A, Port A	28-Dec-92	0.0000
A\PORT B	Col A, Port B	28-Dec-92	0.0000
A\EFF	Col a, Effluent	28-Dec-92	0.0000
B\INF	Col B, Influent	28-Dec-92	5.0570
B\PORT A	Col B, Port A	28-Dec-92	1.9700
B\PORT B	Col B, Port A	28-Dec-92	0.0000
B\EFF	Col B, Effluent	28-Dec-92	0.0000
C\INF	Col C, Influent	28-Dec-92	13.8400
C\PORT A	Col C, Port A	28-Dec-92	0.2930
C\PORT B	Col C, Port B	28-Dec-92	0.0000
C\EFF	Col C, Effluent	28-Dec-92	0.0000
D\INF	Col D, Influent	28-Dec-92	14.4390
D\PORT A	Col D, Port A	28-Dec-92	0.3620
D\PORT B	Col D, Port B	28-Dec-92	0.0000
D\EFF	Col D, Effluent	28-Dec-92	13.4400
E\INF	Col E, Influent	28-Dec-92	1.1940
E\PORT A	Col E, Port A	28-Dec-92	0.0000
E\PORT B	Col E, Port B	28-Dec-92	0.0000
E\EFF	Col E, Effluent	28-Dec-92	
1 ppm	Standard	30-Dec-92	1.0990
1 ppm	Standard	30-Dec-92	1.0930
1 ppm	Standard	30-Dec-92	0.9740
A\INF	Col A, Influent	30-Dec-92	9.6190
A\PORT A	Col A, Port A	30-Dec-92	1.2790
A\PORT B	Col A, Port B	30-Dec-92	0.0000
A\EFF	Col a, Effluent	30-Dec-92	0.0000
B\INF	Col B, Influent	30-Dec-92	7.6890

Code	Description	Date	Analysis (Toluene, ppm)
B\PORT A	Col B, Port A	30-Dec-92	1.8390
B\Port B	Col B, PortB	30-Dec-92	0.6630
B\EFF	Col B, Effluent	30-Dec-92	0.0000
C\INF	Col C, Influent	30-Dec-92	15.1120
C\PORT A	Col C, Port A	30-Dec-92	0.1920
C\ PORT B	Col C, Port B	30-Dec-92	0.1350
C\EFF	Col C, Effluent	30-Dec-92	0.0000
D\INF	Col D, Influent	30-Dec-92	14.8400
D\PORT A	Col D, Port A	30-Dec-92	0.0000
D\PORT B	Col D, Port B	30-Dec-92	0.0000
D\EFF	Col D, Effluent	30-Dec-92	0.0000
E \INF	Col E, Influent	30-Dec-92	15.0690
E\PORT A	Col E, Port A	30-Dec-92	0.1790
E\PORT B	Col E, Port B	30-Dec-92	0.1180
E\EFF	Col E, Effluent	30-Dec-92	0.0000
1 PPM	STANDARD	4-Jan-92	0.9350
1 PPM	STANDARD	4-Jan-92	0.9500
A\INF	Col A, Influent	4-Jan-92	10.3260
A\PORT A	Col A, Port A	4-Jan-92	0.3330
A\PORT B	Col A, Port B	4-Jan-92	0.9350
A\EFF	Col a, Effluent	4-Jan-92	0.0000
B\INF	Col B, Influent	4-Jan-92	7.8080
B\PORT A	Col B, Port A	4-Jan-92	4.8400
B\Port B	Col B, PortB	4-Jan-92	0.7860
B\EFF	Col B, Effluent	4-Jan-92	0.0000
C\INF	Col C, Influent	4-Jan-92	15.3200
C\PORT A	Col C, Port A	4-Jan-92	0.0000
C\ PORT B	Col C, Port B	4-Jan-92	0.0000
C\EFF	Col C, Effluent	4-Jan-92	0.0000
D\INF	Col D, Influent	4-Jan-92	14.9300
D\PORT A	Col D, Port A	4-Jan-92	0.1480
D\PORT B	Col D, Port B	4-Jan-92	0.0000
D\EFF	Col D, Effluent	4-Jan-92	0.0000
E \INF	Col E, Influent	4-Jan-92	14.3400
E\PORT A	Col E, Port A	4-Jan-92	0.2050
E\PORT B	Col E, Port B	4-Jan-92	0.0000
E\EFF	Col E, Effluent	4-Jan-92	0.0000
1 PPM	STANDARD	6-Jan-93	1.0200
1 PPM	STANDARD	6-Jan-93	0.9240
1 PPM	STANDARD	6-Jan-93	0.9990
A\INF	Col A, Influent	6-Jan-93	9.0700
A\PORT A	Col A, Port A	6-Jan-93	1.6100
A\PORT B	Col A, Port B	6-Jan-93	0.0000
A\EFF	Col a, Effluent	6-Jan-93	0.0000
B\INF	Col B, Influent	6-Jan-93	6.9560
B\PORT A	Col B, Port A	6-Jan-93	1.9680
B\PORT B	Col B, PortB	6-Jan-93	0.1710
B\EFF	Col B, Effluent	6-Jan-93	0.0000
C\INF	Col C, Influent	6-Jan-93	13.8200
C\PORT A	Col C, Port A	6-Jan-93	0.4170
C\ PORT B	Col C, Port B	6-Jan-93	0.1480
C\EFF	Col C, Effluent	6-Jan-93	0.1740
D\INF	Col D, Influent	6-Jan-93	14.5840
D\PORT A	Col D, Port A	6-Jan-93	0.0000
D\PORT B	Col D, Port B	6-Jan-93	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
D\EFF	Col D, Effluent	6-Jan-93	0.0000
E \INF	Col E, Influent	6-Jan-93	14.4700
E\PORT A	Col E, Port A	6-Jan-93	0.0000
E\PORT B	Col E, Port B	6-Jan-93	0.0000
E\EFF	Col E, Effluent	6-Jan-93	0.0000
1 PPM	STANDARD	11-Jan-93	0.9060
1 PPM	STANDARD	11-Jan-93	0.9090
A\INF	Col A, Influent	11-Jan-93	7.7000
A\PORT A	Col A, Port A	11-Jan-93	0.0000
A\PORT B	Col A, Port B	11-Jan-93	0.0000
A\EFF	Col a, Effluent	11-Jan-93	0.0000
B\INF	Col B, Influent	11-Jan-93	7.2100
B\PORT A	Col B, Port A	11-Jan-93	4.3100
B\PORT B	Col B, Port B	11-Jan-93	0.4210
B\EFF	Col B, Effluent	11-Jan-93	0.0000
C\INF	Col C, Influent	11-Jan-93	13.1490
C\PORT A	Col C, Port A	11-Jan-93	3.5600
C\PORT B	Col C, Port B	11-Jan-93	1.5300
C\EFF	Col C, Effluent	11-Jan-93	0.0000
D\INF	Col D, Influent	11-Jan-93	14.3700
D\PORT A	Col D, Port A	11-Jan-93	0.8400
D\PORT B	Col D, Port B	11-Jan-93	0.0000
D\EFF	Col D, Effluent	11-Jan-93	0.0000
E \INF	Col E, Influent	11-Jan-93	14.1400
E\PORT A	Col E, Port A	11-Jan-93	0.1630
E\PORT B	Col E, Port B	11-Jan-93	0.0000
E\EFF	Col E, Effluent	11-Jan-93	0.0000
1 PPM	STANDARD	14-Jan-93	1.0480
1 PPM	STANDARD	14-Jan-93	1.0830
1 PPM	STANDARD	14-Jan-93	
A\INF	Col A, Influent	14-Jan-93	7.3200
A\PORT A	Col A, Port A	14-Jan-93	1.2800
A\PORT B	Col A, Port B	14-Jan-93	0.0000
A\EFF	Col a, Effluent	14-Jan-93	0.0000
B\INF	Col B, Influent	14-Jan-93	8.6700
B\PORT A	Col B, Port A	14-Jan-93	5.6600
B\PORT B	Col B, Port B	14-Jan-93	0.0000
B\EFF	Col B, Effluent	14-Jan-93	0.0000
C\INF	Col C, Influent	14-Jan-93	13.5700
C\PORT A	Col C, Port A	14-Jan-93	0.8300
C\PORT B	Col C, Port B	14-Jan-93	0.0000
C\EFF	Col C, Effluent	14-Jan-93	0.0000
D\INF	Col D, Influent	14-Jan-93	12.5600
D\PORT A	Col D, Port A	14-Jan-93	0.9890
D\PORT B	Col D, Port B	14-Jan-93	0.0000
D\EFF	Col D, Effluent	14-Jan-93	0.0000
E \INF	Col E, Influent	14-Jan-93	14.9400
E\PORT A	Col E, Port A	14-Jan-93	0.0000
E\PORT B	Col E, Port B	14-Jan-93	0.1120
E\EFF	Col E, Effluent	14-Jan-93	0.0000
1 PPM	STANDARD	18-Jan-93	1.1020
1 PPM	STANDARD	18-Jan-93	1.1100
1 PPM	STANDARD	18-Jan-93	1.1000
A\INF	Col A, Influent	18-Jan-93	11.7900
A\PORT A	Col A, Port A	18-Jan-93	2.8900

Code	Description	Date	Analysis (Toluene, ppm)
A\PORT B	Col A, Port B	18-Jan-93	0.0890
A\EFF	Col a, Effluent	18-Jan-93	0.0000
B\INF	Col B, Influent	18-Jan-93	9.0900
B\PORT A	Col B, Port A	18-Jan-93	5.5300
B\PORT B	Col B, PortB	18-Jan-93	0.2980
B\EFF	Col B, Effluent	18-Jan-93	0.0000
C\INF	Col C, Influent	18-Jan-93	13.9300
C\PORT A	Col C, Port A	18-Jan-93	0.1540
C\PORT B	Col C, Port B	18-Jan-93	0.2180
C\EFF	Col C, Effluent	18-Jan-93	0.0000
D\INF	Col D, Influent	18-Jan-93	13.4600
D\PORT A	Col D, Port A	18-Jan-93	0.1420
D\PORT B	Col D, Port B	18-Jan-93	0.0000
D\EFF	Col D, Effluent	18-Jan-93	0.0000
E\INF	Col E, Influent	18-Jan-93	12.3900
E\PORT A	Col E, Port A	18-Jan-93	0.8680
E\PORT B	Col E, Port B	18-Jan-93	0.0000
E\EFF	Col E, Effluent	18-Jan-93	0.0000
A\INF	Col A, Influent	21-Jan-93	6.2100
A\PORT A	Col A, Port A	21-Jan-93	0.2390
A\PORT B	Col A, Port B	21-Jan-93	0.2730
A\EFF	Col a, Effluent	21-Jan-93	0.0000
B\INF	Col B, Influent	21-Jan-93	13.6300
B\PORT A	Col B, Port A	21-Jan-93	8.8000
B\PORT B	Col B, PortB	21-Jan-93	1.2380
B\EFF	Col B, Effluent	21-Jan-93	0.6950
C\INF	Col C, Influent	21-Jan-93	17.4400
C\PORT A	Col C, Port A	21-Jan-93	0.2870
C\PORT B	Col C, Port B	21-Jan-93	0.0000
C\EFF	Col C, Effluent	21-Jan-93	0.2650
D\INF	Col D, Influent	21-Jan-93	9.0560
D\PORT A	Col D, Port A	21-Jan-93	0.0910
D\PORT B	Col D, Port B	21-Jan-93	0.0000
D\EFF	Col D, Effluent	21-Jan-93	0.0000
E\INF	Col E, Influent	21-Jan-93	8.9800
E\PORT A	Col E, Port A	21-Jan-93	0.0000
E\PORT B	Col E, Port B	21-Jan-93	0.0000
E\EFF	Col E, Effluent	21-Jan-93	0.0000
1 PPM	STANDARD	25-Jan-93	0.9480
1 PPM	STANDARD	25-Jan-93	0.9190
1 PPM	STANDARD	25-Jan-93	0.9200
A\INF	Col A, Influent	25-Jan-93	22.7900
A\PORT A	Col A, Port A	25-Jan-93	3.9200
A\PORT B	Col A, Port B	25-Jan-93	0.1670
A\EFF	Col a, Effluent	25-Jan-93	0.0000
B\INF	Col B, Influent	25-Jan-93	10.1200
B\PORT A	Col B, Port A	25-Jan-93	0.0000
B\PORT B	Col B, PortB	25-Jan-93	0.0950
B\EFF	Col B, Effluent	25-Jan-93	0.1480
C\INF	Col C, Influent	25-Jan-93	9.1550
C\PORT A	Col C, Port A	25-Jan-93	0.0000
C\PORT B	Col C, Port B	25-Jan-93	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
C\EFF	Col C, Effluent	25-Jan-93	0.0000
D\INF	Col D, Influent	25-Jan-93	9.9860
D\PORT A	Col D, Port A	25-Jan-93	0.1080
D\PORT B	Col D, Port B	25-Jan-93	0.2100
D\EFF	Col D, Effluent	25-Jan-93	0.0000
E \INF	Col E, Influent	25-Jan-93	
E\PORT A	Col E, Port A	25-Jan-93	
E\PORT B	Col E, Port B	25-Jan-93	
E\EFF	Col E, Effluent	25-Jan-93	
1 PPM	STANDARD	27-Jan-93	0.9750
1 PPM	STANDARD	27-Jan-93	0.9890
1 PPM	STANDARD	27-Jan-93	0.9600
A\INF	Col A, Influent	27-Jan-93	13.3800
A\PORT A	Col A, Port A	27-Jan-93	4.6900
A\PORT B	Col A, Port B	27-Jan-93	0.0760
A\EFF	Col a, Effluent	27-Jan-93	0.3750
B\INF	Col B, Influent	27-Jan-93	6.9450
B\PORT A	Col B, Port A	27-Jan-93	0.3320
B\PORT B	Col B, PortB	27-Jan-93	0.1360
B\EFF	Col B, Effluent	27-Jan-93	0.0000
C\INF	Col C, Influent	27-Jan-93	7.6500
C\PORT A	Col C, Port A	27-Jan-93	0.1910
C\PORT B	Col C, Port B	27-Jan-93	0.2570
C\EFF	Col C, Effluent	27-Jan-93	0.0000
D\INF	Col D, Influent	27-Jan-93	16.6900
D\PORT A	Col D, Port A	27-Jan-93	0.2500
D\PORT B	Col D, Port B	27-Jan-93	0.1360
D\EFF	Col D, Effluent	27-Jan-93	0.1090
E \INF	Col E, Influent	27-Jan-93	10.2400
E\PORT A	Col E, Port A	27-Jan-93	0.1600
E\PORT B	Col E, Port B	27-Jan-93	0.0680
E\EFF	Col E, Effluent	27-Jan-93	0.0000
1 PPM	STANDARD	1-Feb-93	0.9430
1 PPM	STANDARD	1-Feb-93	0.9270
1 PPM	STANDARD	1-Feb-93	0.7490
A\INF	Col A, Influent	1-Feb-93	12.0700
A\PORT A	Col A, Port A	1-Feb-93	7.1100
A\PORT B	Col A, Port B	1-Feb-93	2.4700
A\EFF	Col a, Effluent	1-Feb-93	1.1470
B\INF	Col B, Influent	1-Feb-93	13.7300
B\PORT A	Col B, Port A	1-Feb-93	1.2020
B\Port B	Col B, PortB	1-Feb-93	0.5590
B\EFF	Col B, Effluent	1-Feb-93	0.8270
C\INF	Col C, Influent	1-Feb-93	10.4090
C\PORT A	Col C, Port A	1-Feb-93	2.3340
C\PORT B	Col C, Port B	1-Feb-93	0.3550
C\EFF	Col C, Effluent	1-Feb-93	0.1140
D\INF	Col D, Influent	1-Feb-93	8.8270
D\PORT A	Col D, Port A	1-Feb-93	0.8210
D\PORT B	Col D, Port B	1-Feb-93	0.0000
D\EFF	Col D, Effluent	1-Feb-93	0.0000
E \INF	Col E, Influent	1-Feb-93	12.5400
E\PORT A	Col E, Port A	1-Feb-93	2.7870
E\PORT B	Col E, Port B	1-Feb-93	0.1090
E\EFF	Col E, Effluent	1-Feb-93	0.0650

Code	Description	Date	Analysis (Toluene, ppm)
1 ppm	STANDARD	2-Feb-93	0.9400
1 PPM	STANDARD	2-Feb-93	0.9040
1 PPM	STANDARD	2-Feb-93	
A\INF	Col A, Influent	2-Feb-93	9.0800
A\PORT A	Col A, Port A	2-Feb-93	5.3500
A\PORT B	Col A, Port B	2-Feb-93	0.9680
A\EFF	Col a, Effluent	2-Feb-93	0.0000
B\INF	Col B, Influent	2-Feb-93	3.1200
B\PORT A	Col B, Port A	2-Feb-93	0.0130
B\PORT B	Col B, PortB	2-Feb-93	0.1030
B\EFF	Col B, Effluent	2-Feb-93	0.0000
C\INF	Col C, Influent	2-Feb-93	6.3000
C\PORT A	Col C, Port A	2-Feb-93	0.0000
C\PORT B	Col C, Port B	2-Feb-93	0.2160
C\EFF	Col C, Effluent	2-Feb-93	0.0000
D\INF	Col D, Influent	2-Feb-93	6.3100
D\PORT A	Col D, Port A	2-Feb-93	0.0000
D\PORT B	Col D, Port B	2-Feb-93	0.0000
D\EFF	Col D, Effluent	2-Feb-93	0.0000
E\INF	Col E, Influent	2-Feb-93	5.1000
E\PORT A	Col E, Port A	2-Feb-93	0.0840
E\PORT B	Col E, Port B	2-Feb-93	
E\EFF	Col E, Effluent	2-Feb-93	
1 ppm	STANDARD	5-Feb-93	0.8240
1 PPM	STANDARD	5-Feb-93	0.9070
1 PPM	STANDARD	5-Feb-93	0.8900
A\INF	Col A, Influent	5-Feb-93	14.6400
A\PORT A	Col A, Port A	5-Feb-93	6.6200
A\PORT B	Col A, Port B	5-Feb-93	0.2170
A\EFF	Col a, Effluent	5-Feb-93	0.0530
B\INF	Col B, Influent	5-Feb-93	4.5100
B\PORT A	Col B, Port A	5-Feb-93	0.1820
B\PORT B	Col B, PortB	5-Feb-93	0.0000
1 ppm	STANDARD	8-Feb-93	1.1000
1 PPM	STANDARD	8-Feb-93	1.0800
1 PPM	STANDARD	8-Feb-93	0.9910
A\INF	Col A, Influent	8-Feb-93	8.6200
A\PORT A	Col A, Port A	8-Feb-93	
A\PORT B	Col A, Port B	8-Feb-93	0.1200
A\EFF	Col a, Effluent	8-Feb-93	0.0000
B\INF	Col B, Influent	8-Feb-93	8.2250
B\PORT A	Col B, Port A	8-Feb-93	0.0000
B\PORT B	Col B, PortB	8-Feb-93	0.0000
B\EFF	Col B, Effluent	8-Feb-93	0.0000
C\INF	Col C, Influent	8-Feb-93	7.9600
C\PORT A	Col C, Port A	8-Feb-93	0.0000
C\PORT B	Col C, Port B	8-Feb-93	0.0000
C\EFF	Col C, Effluent	8-Feb-93	0.0000
D\INF	Col D, Influent	8-Feb-93	7.7400
D\PORT A	Col D, Port A	8-Feb-93	0.0000
D\PORT B	Col D, Port B	8-Feb-93	0.1190
D\EFF	Col D, Effluent	8-Feb-93	0.0000
E\INF	Col E, Influent	8-Feb-93	8.5600
E\PORT A	Col E, Port A	8-Feb-93	0.0000
E\PORT B	Col E, Port B	8-Feb-93	0.0000

Code	Description	Date	Analysis (Toluene, ppm)
EEFF	Col E, Effluent	8-Feb-93	0.0000